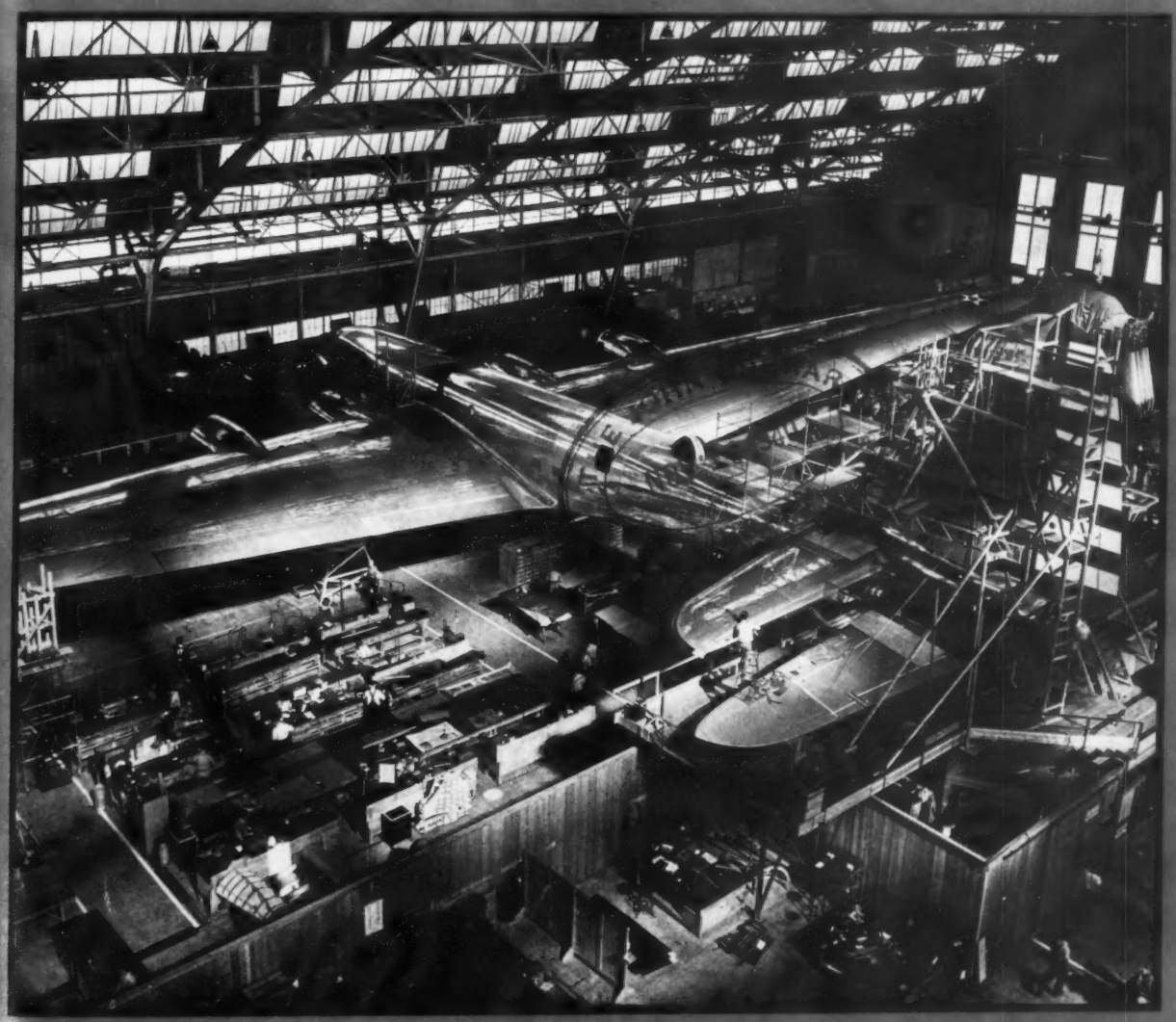
JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION



VOLUME 8 NOVEMBER, 1940 NUMBER 1

Perhaps there is no niche in the Hall of Fame for a gasoline, and no laurel wreath to fit an oil. But with every new triumph of aviation, Shell engineers and scientists find a deep satisfaction in knowing that their efforts have helped somewhat to bring new glories to a great American industry.

AVIATION PRODUCTS

JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

CONTENTS

COVER ILLUSTRATION—THE DOUGLAS B-19 BOMBER (SEE PAGE 35)

Editorial 3

Books 5

- Airpower
- Baughman's Aviation Dictionary
- The Flying Reference Book
- Military Medical Manual
- Marine Navigation
- Aerial Photos
- Sky Roads
- Let's Fly
- A History of the Air Ministry
- Aviation from the Ground Up
- Aviation—Manufacturing, Transportation
- Dictionary of Metals and Their Alloys
- The Story of Flying
- Chemistry in Warfare
- War Wounds and Air Raid Casualties
- The Ground Engineer's Manual
- Principles of Air Law
- The Design, Construction and Management of Airports

News Review 9

Periodicals 11

House Organs and Catalogues 27

From the Industry 33

Plastics Bibliography 39

Institute of the Aeronautical Sciences 45

Statements and opinions advanced in Reviews are to be understood as individual expressions and not those of the Institute.

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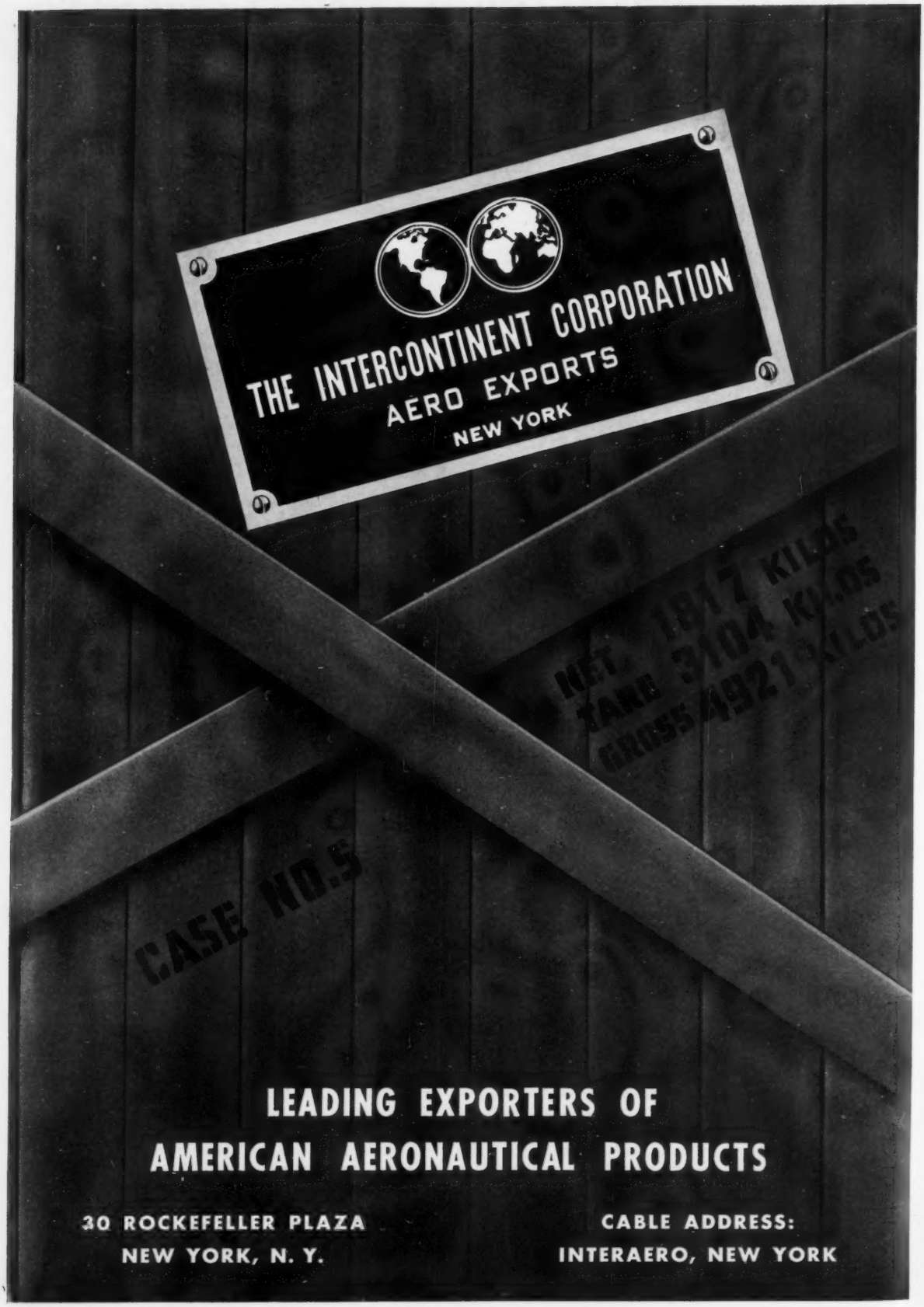
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Why the Review?

TODAY, MEN OF THE aircraft industry, working overtime to meet a great emergency, find it more and more difficult to do any large amount of reading. Time is vital, yet day and night work set severe limits upon their time, so that many of the hours once given to reading are now crowded with demands for more and more work and necessary rest.

Men, like companies, must keep up with technical advances or be left behind—but many find it almost impossible to handle the immediate matters concerned with their work, and at the same time keep abreast of the large flow of current publications, many of which may be of direct value to them in their professional career.

The picture, as it now confronts us, is that of a vital industry flooded with orders, beseiged with demands for ever-increasing output, short-handed and often over-worked, and keenly feeling the need of swift notice of every helpful advance that is made. The men of aviation need and want to read more than ever before, and there is much more for them to study—but far less time available in which to do it.

There is an obvious, sensible, and simple solution to this problem. It is this: for each individual first to read only those books and articles that concern his own specialty, directly or indirectly, thereby obtaining the information that is most essential to him.

Reader for the Industry

However, there is too large a volume of specialized information published for anyone to be sure that he has seen everything bearing upon his own quite definite interests. To be certain that nothing has been missed, it has been necessary to see everything—which is precisely what no one can do today. There are not only the new books that appear almost daily, but also over one hundred aeronautical periodicals available, and anyone who attempted to examine every page of each would find himself doing little else.

Obviously, unless some organization undertakes to read and report upon this flood of printed matter, large portions of it may not reach the busy man and thus not fulfil its purpose. It is this function of reader for the industry that the Aeronautical Review performs, presenting brief, compact, readable reports. Thus a quick survey can be made of each month's magazines. Within an hour or less, the engineer, the designer, the production man, the pilot, the mechanic, the student—anyone interested in aviation—can scan the Review and know exactly which books and periodicals are of such a nature as to justify the devotion of precious time to their study.

It will be noted that this plan calls for identification and classification, rather than digesting. The Aeronautical Review is not a substitute for books and magazines, but a guide to and through them; not a condensation, but a description; a review rather than an abstract.

To give still further service to the reader, each issue will contain a bibliography in some special field.

Free Lending Library Service

Books listed in these bibliographies and reviewed in these pages may be borrowed from The Paul Kollsman Library, under whose auspices and with whose support the Aeronautical Review has been established. When that Library was formed it was felt that its operation should include more than the placing of a large number of aviation books upon the shelves for lending to accredited persons. In addition, it was planned to make available a publication that would describe or review aeronautical material so that selection would be facilitated for the student, the reader, the borrower. The Aeronautical Review thus rounds out the large and swiftly growing contributions being made to aviation progress by the Library.

Important though The Paul Kollsman Library and the Aeronautical Review are, they constitute but a portion of the activities and functions of the Institute of the Aeronautical Sciences, whose growth has paralleled that of the aviation industry because it, too, renders an essential service. So great has been the expansion of the Institute during recent years that it is felt that even some of its own members may not be fully acquainted with the scope and the nature of the manifold facilities it now makes available. For that reason, and to introduce the work of the Institute to those who have recently entered the aviation field, there is included in this issue a complete review of the Institute, its history and development, and an account of its various services.

The Paul Kollsman Library

of the

Institute of the Aeronautical Sciences

A new lending library service of the Institute which makes available, without charge, the latest and more important aeronautical books to members of the Institute and others interested in aeronautical progress.

Membership in the library is open to all members of the Institute of the Aeronautical Sciences and to any person in the United States over 18 years of age who can furnish references which certify as to his responsibility and reliability.

The Aeronautical Reader's Guide

A catalogue of selected aeronautical books available for loan from The Paul Kollsman Library. The Guide lists and comments on books and by indexing them under specialized headings also acts as a valuable reference source for aeronautical specialists, companies, libraries and other organizations.

The Guide is issued quarterly in September, December, March and June, and is priced at $1 for the four issues in each volume. Single copies are not available and subscriptions may only be accepted for complete volumes.

Further information will be sent on request.

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Air Power—Take It or Leave It

Probably no controversy in military and naval circles has ever created so many bitter animosities as has the question of an independent or separate air force. On one side are Army and Navy officers who want to retain their control over aircraft for military and naval use. In opposition are those who regard General William Mitchell as a leader.

Major Al Williams is a direct descendant of General Mitchell's contentions. In his book, he is as caustic as his predecessor in stating his opinion of military and naval leaders. He opens the throttle wide in his book as in his newspaper writings to give speed to his arguments for the development of air power as the first line of defense of our country. He assails the non-flying administration of military and naval aviation. He bases his opinions on his personal observations in Europe where he was given exceptional opportunities to study the latest products, aircraft production and the directing personnel.

Probably no book ever written on airpower was so deliberately provocative. The author frankly admits that he will be labeled pro-this and anti-that but is so convinced that someone should speak boldly of the mistakes, the intrigues, and the failures that he believes have been made in the United States and abroad that he strikes boldly, without fear, in every direction where he suspects weakness, hypocrisy, and political sabotage.

In his trips to Europe in 1936 and 1938 he made an intensive study of new types of airplanes, visited factories and laboratories, discussed airpower with its leading proponents, and make copious notes. No one who reads his book will believe that he was a gullible visitor who was being hoodwinked by propagandists.

His praise of German progress and technical skill and his admiration of Italy's air program will not be pleasing reading to many. His accounts of the disintegration of France and the bitterness of his analysis of the failure of Great Britain to prepare for the clearly foreseen war in the air will be resented and its accuracy challenged. As he admits repeatedly, he is attempting to piece together a picture from what he has seen, the things he has been told, much of which he questions, but, more important, the conclusions he has reached, based on his long experience as a pilot.

He is convinced that the future of airpower will be influenced greatly by research. He emphasizes the status of the United States with less than a thousand engineers and scientists engaged in aeronautical laboratories as compared with a similar program in Germany where he found over seven thousand engineers exploring every possibility of the aeronautical sciences. While he concedes that engineers, scientists, and constructors need not be trained pilots, he emphasizes again the necessity of having men with wide flying experience formulate and administrate every phase of our national air policy.

As Captain Rickenbacker says in the foreword he has written for the book, "There is no haven for sympathies, no tempering of unpleasant facts, no compromise with truth to be found in this book. Many will disagree with him—some perhaps violently, for this story of air power—like airpower itself, which upset European military and naval traditions of centuries—is new and strange. Knowing Al Williams as I do—I feel he might just as well have titled this book 'Like It or Leave It—Air Power.'"

Entirely apart from the controversial parts, the book describes the latest types of European military aircraft and their power plants from the point of view of an experienced pilot. Regardless of the heat generated by the political and international observations, his evaluations of the construction and performance of German, English, French and Italian airplanes is as cool as his inverted flying at air races.

To give a broad foundation for his conclusions and assertions, Major Williams gives detailed descriptions of the air warfare in the Spanish, Norwegian, and European campaigns up to July of this year. They are necessarily drawn from sources and information that are under stringent censorship restrictions and will have to be read with reservations, but the author has tried to obtain all the facts possible at this time and gives his interpretations of the events, many of which will necessarily require modification when the veil of secrecy is lifted.

Persons who have high blood pressure and strong international leanings should be prepared to have their preconceived ideas assaulted, their ideals undermined, and suffer a disillusioning which will make them mad. Probably the author believed that by a shock attack he could at least arouse discussion. He is fully aware of his exposed position for he writes: "And if anyone cares to launch such poisoned arrows in my direction, I bid him print the following indictment in big letters and serve it upon me—'You are accused of being an American.'"

Airpower, by Major Al Williams; Coward-McCann, Inc., New York, 1940; 433 pages, $3.50.

Aeronautical Words and Terms Defined

Every industry quickly develops its own nomenclature by a process of borrowing, adapting, and sheer invention under pressure of necessity. Many terms thus created are essentially self-explanatory, especially those due to a flash of inventive word-genius, but others are not so clear and need strict definition. Hence the need in every business for a comprehensive dictionary.

The newer the field and the faster its growth, the greater is the necessity for a somewhat different type of information, such as is found in reference works.

Both these basic requirements have been filled for aviation's newcomers and old-timers alike in a single book prepared by Harold E. Baughman with the assistance of several airplane manufacturers. Inasmuch as the volume includes not only a dictionary of terms, but a large reference section in which some material, such as the directory of firms and airports, is liable to change, it is to be assumed that this 1940 edition is the first of an annual series. The comprehensive dictionary portion defines approximately 3500 words and occupies 195 pages, the rest of the compendium being given over to exceptionally complete reference material useful to pilot, designer, engineer, mechanic, superintendent, and, in fact, to anyone associated with aircraft manufacture, operation or maintenance.

Baughman's Aviation Dictionary and Reference Guide, by Harold E. Baughman; Aero Publishers, Inc., Glendale, Calif., 1940; 598 pages, $5.00.

About British Aviation

The first edition of this English directory appeared in June, 1939. This second edition gives still more evidence of the intensity of British application to aviation. In the preface, it is stated that the English aircraft industry employs nearly 200,000 skilled workers.

Though entitled a reference book, it is more in the nature of a directory and a compilation of general rather than technical information. Some non-secret military and commercial planes are illustrated and described; there are lists of British airports, flying clubs, world records, international air routes, a chronology, and similar material. The functions and nature of the leading English aeronautical organizations are given, and a brief dictionary defines the more common terms employed in factory and field.

The Flying Reference Book, by F. J. Camm; Reginald Saunders, Toronto, Canada, 1940; 208 pages, $1.75.

Aviation Medicine Included in New Manual for Medical Officers

When the airplane first appeared as a military weapon, there was no immediate realization that it was bringing with it an entirely new series of medical problems. These had to be revealed by experience with the effects of aerial warfare upon the psychological and physical capabilities of pilots. Consideration of these and other aspects of aviation are to be found in a new and authoritative volume on the practice of medicine in the army.

Its chapter on aviation is necessarily brief in a work that surveys the entire, tremendous, and complex field of the military doctor. The history of medicine in relation to aeronautics is sketched, and there is an excellent outline of the duties and qualifications of the flight surgeon of today, who must not only be a capable physician, but also know psychology and psychiatry, and be acquainted with altitude physiology and similar topics. In addition, he must be thoroughly familiar with the work of an airplane pilot and his crew.

It was to train medical officers and their technical assistants in these specialized directions that a School of Aviation Medicine was established in 1931. A few years later, the Physiological Research Laboratory was established as the outgrowth of previous investigations. The book outlines both these organizations.

Subjects correlated with aviation are introduced elsewhere in the Manual, such as map reading, interpretation of aerial photographs, chemical attacks from planes, missions performed by aviation, pick-up of messages from the ground, and similar details in which any army officer, including medical officers, must be expert.

In a foreword to this thorough and comprehensive book, Major General James C. Magee, Surgeon General, U.S.A., states that earlier editions proved of great help to medical officers, particularly in the National Guard and Reserve, and that the new edition meets "the requirements of current practice and may be accepted as a practical and reliable text."

Military Medical Manual, Third Edition; The Military Service Publishing Co., Harrisburg, Pa., 1940; 837 pages, $4.50.

Sailors Pay Tribute to Aviation-Created Improvements in Navigation

With the development of long-distance flying, particularly over water or clouds, there arose a vital need for improvements in navigational methods and instruments. Air navigators applied themselves assiduously to the new problems that arose when ascertaining position and course while flying at high speed, and within a relatively short time such advances had been made as to enable a plane to steer for its overseas destination with as much (if not greater) accuracy and ease as a vessel.

The new procedures and devices thus developed now are being taken up by those who sail the sea, as is evidenced by a new volume on navigation designed for practical use aboard ship. The book contains a well-deserved tribute to aviation "for improvements in practically every item of navigation equipment except the sounding machine."

The gyro-compass, with its theory and its development by Sperry; the bubble sextant; and the second-setting watch are some of the modern instruments described in detail, including their principles, construction, and use. The Air Mass theory, Lambert projection charts, the Air Almanac, and star altitude curves are other subjects that will be welcomed by the mariner. The work is a companion to the well-known "Air Navigation," published by McGraw-Hill. It is amply illustrated.

Marine Navigation, by P. V. H. Weems, Lieutenant Commander, U.S.N. Retired; D. Van Nostrand Co., Inc., New York, 1940; 443 pages, $6.00.

Aerial Photography Introduced to the Amateur

Since the popularization of amateur photography, there has been a growth in the number of amateurs who would like to make their hobby profitable. Some years ago one of the latter turned his inexpensive equipment into a makeshift aerial camera, and, to the surprise of a pilot friend, made money with it.

The young man was Claud J. Dry, now a professional aerial photographer. He has just written an elementary pamphlet that tells others how to make a start in this field, with expensive manufactured cameras if they can, but with makeshifts if they must. In addition to simple details of equipment and methods, information is included on where to sell aerial photographs and what prices to charge.

Aerial Photos, How to Make and Sell Them, by Claud J. Dry; The Aircraft Directory, Athens, Ohio; 67 pages, $1.00.

Airline Pilot Surveys His Work

Many people seem to have the impression that flying across country is much like covering the same distance by automobile, but faster and easier. Any such illusions are quickly dispelled by Ernest K. Gann's book, in which the reader will discover that transport flights have the appearance of simplicity and facility only because of the perfect skill with which multitudinous and complex tasks are accomplished.

Mr. Gann flies for American Airlines, and in terms that are both general and ingratiating describes his and every commercial pilot's job, what he has to be and do to get it, and what he must do to keep it. There is an account of the stiff tests that applicants must pass. Stress is laid upon the many essential technical skills, such as mathematics, navigation, meteorology, and radio, and upon the ability to make instant and accurate use of them—"good enough" will not do. An imaginary flight is described, during which thunderstorms, icing conditions and fog are encountered. Photographs and diagrams are used generously, and there is an introductory historical section going back to the post-war career of the famous "Jenny."

Recommended especially to young men with some time on their logbooks who are thinking of applying for an airline job, and to anyone else who imagines it's an easy one.

Sky Roads, by Ernest K. Gann; Thomas Y. Crowell Co., New York, 1940; 123 pages, $2.00.

Easy Lessons on How to Fly

Those contemplating or taking a course of flight instruction will be interested in a new book by Lieut. Vetter, based on the C.A,A. course and therefore technically correct according to current practice, but written in a manner that is exceptionally easy to read and understand. In a simple, conversational style the reader is given the reasons why an airplane flies, an explanation of the controls and instruments, and then is taken up in a trainer. Before and during these imaginary flights, the various maneuvers and the uses of the controls are explained. Starting the engine, taxiing, taking off, ascertaining wind direction, turns, stalls, spins, and landings are discussed from the practical point of view. The book contains only 116 pages and will give anyone the ABC's of flying in an hour or two of enjoyable reading.

Let's Fly, by Lieutenant Ernest G. Vetter, U.S. Naval Air Reserve; William Morrow & Co., New York, 1940; 116 pages, $1.50.

Why England Merged Her Air Power

Those who are familiar with the usual style of C. G. Grey's writings will be surprised to find that he can write factually with as great facility as when he is tilting at windmills or airplanes that will land slowly and not burn up. In this short history he avoids expressing his personal opinions as much as possible. He quotes the opinions of others. Even with the best of intentions, the author unconsciously adds interest to some of these views by his introduction of colorful side lights and anecdotes.

The book was published at an opportune time. It coincided with a revival in the United States of an agitation for some sort of a separate or independent air force. The book will bring strong arguments to support this point of view.

Beginning with struggles of British aviation to organize itself in the prewar days, the chapters present the many reasons which caused the British government during the World War to separate the air service from Army and Navy control and form an Air Ministry in November, 1917. It took scandals, enquiries, and a World War to make the English decide that their air arm should have a separate entity not under the control of the older services and with an Air Minister to present its claims to Parliament.

Following this, the Independent Air Force was created under General Trenchard who later became Lord Trenchard and was destined to have the distinction of becoming the creator of the modern Royal Air Force. The Independent Air Force was formed too late to render the effective service it might have had it been in being at the start of the War.

After the War came the period of organization under many Air Ministers, each of whom brought to the office new ideas and new changes. The author describes these successive changes with an intimate knowledge of events and a keen appraisal of personalities. He traces the shortcomings as well as the gains made up to the present war.

While much of the book will not be of great interest to readers in this country, owing to their lack of knowledge of many of the politicians and officers whose part in the upbuilding of the British Air Ministry and Royal Air Force is described in great detail, they will be interested in the history of the development of an independent air force.

It is this record that gives the book its great value, apart from the lucid style in which it is written, as a textbook for countries without separate air forces but which are contemplating forming them.

A History of the Air Ministry, by C. G. Grey; George Allen & Unwin, Ltd., London, 1940; 319 pages, 10*s.* 6*d.*

Aviation for the General Reader

Engineers, executives, and others faced with the problem of recommending aviation books to the practical but nontechnical man now can mention a new and useful volume of value to seekers after basic and general facts and information. The author is Lieutenant Manly of the U.S. Army Air Reserve.

Fundamentally, the approach is that of giving the "what" and the "how" of the airplane and its components, in sufficient detail to familiarize the reader with construction, operation, and, to some extent, maintenance. When necessary, the "why" is stated in language as plain as the rest. There are no mathematics. Under this plan the chapter on the theory of flight is necessarily brief and simple—and all the more easily assimilable by the average mind. Some other subjects treated include engines, rigging, instruments, weather, navigation, propellers, how to learn to fly, parachutes, and air regulations. There are many illustrations, and a short chapter defining aviation terms.

Aviation from the Ground Up, by Lieutenant G. B. Manly, U.S. Army Air Corps Reserve; Frederick J. Drake & Co., Chicago, 1940; 396 pages, $3.00.

Financial Analysis of the Aircraft Industry

Every new industry passes through a period when there is a vital need for statistics. This has led many investment trusts, publishing houses, and stock brokers to undertake exhaustive investigations of the financial status of individual aircraft and air transport companies. Some of these studies have been published from time to time.

White, Weld & Company published their compilation and analysis for their clients but the book is also available to the general public. It is divided into two sections. In the first, Donald Ross makes "An Appraisal of Prospects for the Aircraft Manufacturing Industry," discussing each company separately and carrying sales and earnings records back to the earliest possible date. Significant ratios, such as floor space and dollar output per employee, are given, these and similar figures recently having been found of value in comparing companies. Production for 1940 is estimated, and in some instances for 1941 as well.

The second section, by David Weld, "A Review of the Air Transportation Industry," contains traffic, revenue, and similar statistics for the years from 1935 through 1939.

Aviation—Manufacturing, Transportation, by Donald Ross and David Weld; White, Weld & Co., New York, 1940; 144 pages, $3.00.

Basic Data on Metals and Alloys

The manufacture of aircraft involves the use of so many metals and alloys that there is a need for a simple source book of general information about these materials. For this reason the appearance of an alphabetically arranged dictionary of metals is to be welcomed.

The new volume describes every known metal briefly, giving its physical, chemical and electrical properties, and usually its source. Since the number of possible alloys is infinite, only those of commercial importance are listed, stating their composition and in some instances their uses and characteristics.

A data section is also provided, presenting information on such processes as heat-treating, plating, polishing, coloring, and the deposition of coatings by the metal-spray method. Gages, hardness numbers, melting points and similar details are tabulated also in this section.

Dictionary of Metals and Their Alloys, edited by F. J. Camm; Chemical Publishing Co., Inc., New York, 1940; 245 pages, $3.00.

The Background of Aviation

There are few books on aeronautics that have been written by anyone who has followed the art and science of flight more intently than the author. As a result, he has avoided the pitfalls and inaccurate impressions which so frequently appear in books written as the result of book research.

Even with all the care that is shown elsewhere in the book, the author makes errors about the flights of the Wright Brothers. He states that "Thus one may scan the pages of many of the daily papers of Thursday, December 17, and Friday, the eighteenth, 1903, without finding a single line of reference to this important event of history." This legend, which appears in many books, should be corrected. As the flights occurred at noon on the 17th, it is natural that the papers of that day carried no accounts of the flights but a little searching on the part of the author would have revealed excellent stories in New York, Norfolk, Dayton, Chicago, Cincinnati, and Associated Press papers of the 18th.

The author gives December 23, 1907, as the date on which the United States Government gave the Wright Brothers their contract. This was the date on which bids were asked for. The first flight of Orville Wright at Ft. Myer was on September 9th, not September 3rd.

These corrections are not made in a critical spirit but for the record. Readers should not by implication regard other parts of the book inaccurate as that is not the case.

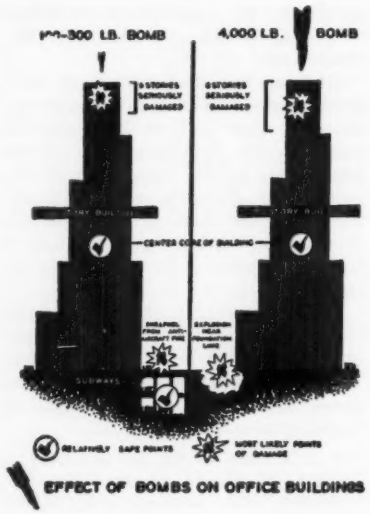
Following the historical part of the book, chapters are devoted to air mail, famous flights, the aircraft industry, airports and air transport, concluding with a vision of the future. It is a book that will appeal to the new generation of pilots who wish to know more about the background of their art.

The Story of Flying, by Archibald Black; Whittlesey House, New York, 1940; 267 pages, $2.75.

If New York Were Bombed

Studies of the results of aerial attacks upon cities in Spain, Poland, and England now make it possible to reach conclusions as to the probable effects of air bombs upon a large city such as New York. Many of those estimates are contained in a new volume that popularizes the general subject of chemistry as it applies to warfare.

Experience shows that a 100 to 300 pound bomb dropping in a residential section demolishes at least three ordinary five- or six-story houses, according to this book. In the case of a steel-framed skyscraper, however, the effects are less severe. In this type of construction, each section of the building is independently supported on the foundations, and even though the whole is inter-connected, total collapse is unlikely.



EFFECT OF BOMBS ON OFFICE BUILDINGS

Assuming a 300 pound bomb to drop vertically upon the top of a 50 story building, then, it is thought that the top five floors would be seriously damaged, while one of 4000 pounds would wreck eight floors. This would make the center core of such a structure the safest place to be, while outside offices, houses, streets, and shallow subways would be dangerous.

These and other facts about the effects as well as the chemistry of modern weapons give the book an importance and interest far greater than its modest size would seem to indicate, and it has been carefully studied by certain city officials.

Its treatment of the function of wartime chemistry popularizes the subject for the average man, stating in general terms how vital chemistry is during the production of materials such as steels, airplane dope, fuels and lubricants, aluminum and its alloys as used in planes, balloon cloth, the supplies required for aerial photography, and similar articles and substances. The very interesting chapter on gases concludes with an estimate of the probability and effects of a gas attack upon New York from the air.

The only chemical formulae are in the appendix, and concern the fundamental reactions employed in producing certain explosives and gases. A bibliography of historical and semi-technical books on related subjects is included. This is an exceedingly timely book, much broader in scope and more important to us all than its title implies.

Chemistry in Warfare, by F. A. Hessel, W. J. Martin, and M. S. Hessel; Hastings House, New York, 1940; 163 pages, $2.00.

Treatment of Air Raid Casualties Discussed by English Doctors

Physicians in a belligerent country who continue their practice at home instead of joining the forces find as great a need for information on the treatment of air raid casualties as do their colleagues in military service. This consequence of the waging of war upon the civilian by means of the relatively new weapon of the airplane makes a new English medical book of considerable interest to all physicians, due to the inclusion of several papers on the treatment of injuries suffered from the air.

It is significant that one of these papers, by Dr. John Rickman, entitled "The Mental Aspects of A. R. P.," stresses not merely the physical and mental symptoms and effects of panic, but also points out the role to be played by the doctor in the maintenance of morale. Thus the medical man is drawn into a field heretofore considered to belong to the propagandist and the government official.

An important companion piece to this, headed "Psychological Emergencies in War Time," by Dr. Maurice B. Wright, diagnoses mental disturbances; an outline of their treatment, by the same author, follows. Other aspects of air war are found in discussions of the effects of gas, the detonation of high explosives, and carbon monoxide poisoning.

Most of the papers in the book were originally given as lectures in the British Postgraduate Medical School; the others were contributed at the invitation of the British Medical Journal, in which all were printed in a series beginning in April, 1939. Being of recent date, they reflect current experience, and their usefulness to the medical profession led to their publication in book form. In addition to air raid articles, there are a number upon various aspects of gunshot and other wounds in various parts of the body.

War Wounds and Air Raid Casualties (23 articles by 18 authors); H. K. Lewis & Co., Ltd., London, 1939; 256 pages, 10*s.* 6*d.*

British Ground Practice in Quiz Form

The flow of pilots and ground crews across the Canadian border and even over the ocean has brought with it a few complications due to some slight differences in British nomenclature and practice. How many Americans, for example, can define "swarf?" Perhaps it is a reflection of current conditions that an English ground engineer's manual has been released in this country. Its 506 questions and answers relate chiefly to the materials used in aircraft, their qualities, how they are inspected, tested, and identified, and how they must be handled in repair work. There are a few pages of logarithms, useful formulas and conversion tables, and an index. Those expecting to discuss ground work with the English might slip this book into their pockets.

The Ground Engineer's Manual, by A. C. Robinson; Reginald Saunders, Toronto, 1940; 128 pages, $1.25.

Air Law in Mexico

Air law has been discussed for years in Europe and the United States, and much has been written about it, but in Latin America little has been published. Now a book from Mexico can be added to the legal library.

The author, a lawyer, is a Mexican. There are two sections, the first of which considers the history and general aspect of air laws, concluding with an historical survey of their development in Mexico. The second part reviews the principles of today's Mexican jurisprudence as applied to concrete subjects, such as airports, airplanes, crimes committed in the air, and similar matters. Pertinent excerpts from current laws are quoted.

Principles of Air Law (Principios de Derecho Aereo), by Antonio Francoz Rigalt (In Spanish); Talleres Graficos del Estado, San Luis Potosí, Mexico, 1939; 139 pages, $2.00, U.S.

A Survey of Airport Operation

In 1936 the Visitors' Grants Committee of the Carnegie Corporation authorized Capt. Makepeace to visit airports in North America, England, and Germany in order that the information thus obtained might be used in the formulation of an airport administration and construction policy for South Africa, where he is manager of the Rand Airport.

His report, long delayed in publication by circumstances beyond his control, has only just reached this country. It is divided into three sections: (1) administration, ownership and financial condition; (2) design, management and traffic control; and (3) recommendations for South African policies.

The Design, Construction and Management of Airports, by Captain Roy Makepeace; The Carnegie Corporation Visitors' Grants Committee, Pretoria, South Africa, 1939; 181 pages, 1*s*.

News Review

September 1. The Boeing Aircraft Company was awarded, by the War Department, a contract for 277 heavy bombing airplanes at $70,449,955.20. The Lockheed Aircraft Corporation was awarded a contract for 410 interceptor pursuit airplanes at $30,278,787.00. The Navy Department awarded the United Aircraft Corporation a contract for 17,000 Pratt & Whitney engines for approximately $160,000,000.00. The Army and Navy have joint requirements for the fiscal years 1941 and 1942 with the Wright Aeronautical Corporation for approximately 20,000 Wright engines and 14,000 Curtiss propellers involving contracts of about $323,000,000.00. The War Department awarded a contract to the Vultee Aircraft Corporation for 500 trainers at $7,488,782.50 and to the Ryan Aeronautical Company for 200 trainers at $2,074,234.00.

September 1. Theodore P. Wright, Vice-President of the Curtiss-Wright Corporation, was appointed Chairman of the newly created Aeronautical Standards Board of the Society of Automotive Engineers.

September 1. The Pan American Airways Corporation filed an appeal of the decision of the C.A.A. with the U.S. Circuit Court of Appeals. The C.A.A. gave the American Export Airlines rights to fly a route to Europe parallel with the present clipper route of Pan American. This was the first appeal to the Court ever made over a decision of the C.A.A.

September 2. J. Shelly Charles won first place in the American Open Soaring Contest held at Lockport, Illinois.

September 2. The National Defense Advisory Commission reported that the present airplane production was roughly 1000 airplanes a month.

September 2. Donald Lawrence, of Newark, was winner of the Glider Contest, held at Schley Field, New Jersey, reaching a height of 4300 feet, and remaining in the air for 38 minutes.

September 6. Colonel Donald H. Connolly was appointed Administrator of Civil Aeronautics.

September 6. The "Veteran Air Pilots" was organized to give recognition to men who have had long records of flying time.

September 8. The first annual award of the Getulio Vargas Cup was presented to Major Harold Lee George, and the Second Bombardment Group of the Army Air Corps for goodwill flights to Rio de Janeiro last November.

September 10. E. Hamilton Lee, United Air Lines pilot, received the Men with Wings award.

September 10. The War Department awarded a contract to the Bell Aircraft Corporation for 120 pursuit airplanes at $4,962,220.00.

September 11. Raymond U. Whitney, of Chardon, Long Island, an enlisted man in the Army Medical Department, was awarded the Distinguished Flying Cross for having subjected himself to exposure and abnormal pressures at high altitudes during stratosphere flight research.

September 11. The TWA Stratoliner set a new speed record for commercial flying between Chicago and New York, Monday night, September 9th. The Stratoliner flew the 778 mile route in two hours and 52 minutes.

September 11. The Pan American Airways began carrying passengers between the United States and New Zealand.

September 12. Miss Jacqueline Cochran has been awarded the annual trophy of the International League of Aviators for 1939, as the outstanding woman pilot in the world. This is the third successive year Miss Cochran has won this award. Major Alexander de Seversky, builder of the

airplanes used by Miss Cochran, was named the winner of the League's 1939 award for men. William A. Bishop, World War Ace, was named the outstanding Canadian flier for 1939 by the League.

September 14. The Pan American Atlantic Clipper made its first non-stop western flight between Lisbon and Bermuda—and made its 200th crossing.

September 14. An embargo was placed on aviation gasoline, its specifications and formulas, as well as airplane and engine designs.

September 15. New Hangar and Administration Building were dedicated at airport at Westfield, Massachusetts.

September 15. An order was issued by the Civil Aeronautics Board, transferring the permit formerly used by the Imperial Airways, Ltd., to the Airways Atlantic, Ltd. This permit authorizes the Airways Atlantic, Ltd., to engage in transatlantic air service between the United Kingdom and Northern Ireland and the United States, via Canada, Newfoundland, and Ireland.

September 15. The Civil Aeronautics Board announced that all owners of aircraft who lease, rent, or lend their airplanes to other pilots, hereafter will be liable to the Government's attaching the planes as security for payment of any penalties imposed on the borrowers for violation of safety regulations.

September 15. The Glenn L. Martin Company broke ground for the first of several factory additions to its plant. This addition will add 400,000 square feet of floor space.

September 15. William M. Finlay, of the Wright Aeronautical Corporation, was appointed Manager of the new aircraft engine factory that is to be built at Lockland, Ohio. Mr. Finlay has been connected with the Wright organization since 1927.

September 17. Arthur Starnes made a parachute jump with 102 pounds of delicate equipment, falling three miles in one minute and thirty-two seconds.

September 19. Bennett E. Pousley landed at LaGuardia Field this morning, to end a 17,000 mile air trip through 22 Latin American countries, where he was a "goodwill ambassador" for the American Hotel Association.

September 19. An American air squadron, similar to the Lafayette Escadrille, was organized by American volunteer fliers in Great Britain. The organization will be called the Eagle Squadron, and is headed by Charles Sweeney.

September 19. Captain George F. McGuire, of the Army Air Corps, Bolling Field, was presented with the Soldier's Medal for heroism in rescuing a fellow-officer from a burning airplane.

September 19. The Aeronautical Chamber of Commerce estimated that there was now being built and delivered to the British 500 airplanes a month, and predicted that a building peak of 1000 airplanes a month would be reached by the first of March.

September 20. Secretary Stimson announced that contracts had been let for 9174 Army airplanes, which was almost one-half of the 18,641 Army airplanes for which Congress appropriated funds this session.

September 22. DeWitt Wallace, of Pleasantville, N. Y., Editor of Readers' Digest, presented his Fairchild monoplane to the Canadian Government.

September 22. Squadron Leader Douglas Bader, legless leader of the All-Canadian Squadron of the Royal Air Force, has been awarded the Distinguished Service Order for gallantry in flying operations against the Germans.

September 23. Guy W. Vaughan, President of the Curtiss-Wright Corporation, announced plans for construction and equipment of a magnesium foundry for the manufacture of castings for aircraft engines.

September 23. The Douglas Aircraft Company has received the largest military aircraft order ever placed with one company in America. The order calls for the construction of more military planes than all the first-line fighting airplanes now used by the U.S. Army.

September 24. The House Appropriations Committee rejected the proposal to provide an airmail subsidy for the projected transatlantic service of the American Export Lines, Inc. The House Committee reported that it could find no present need to be served by this additional service, inasmuch as the present service by the Pan American Airways was satisfactory.

September 25. The plane used by Wilbur and Orville Wright in the famous Kitty Hawk flight of 1903 has been stored by the Science Museum of South Kensington, England, for protection against air raids.

September 25. The Packard Motor Car Company has commenced construction of new buildings for mass production of 9000 Rolls-Royce Merlin engines.

September 26. Major General H. H. Arnold, Chief of the Army Air Corps, stated that the American aircraft industry would be turning out 3000 fighting planes a month by April 1, 1942. He also estimated that the Air Corps would have 12,000 planes ready for action with sufficient trained personnel to handle them.

September 26. The aviation industry backlog throughout the United States is $2,000,000,000, as compared with $300,000,000 a year ago.

September 26. The TWA New York bound Stratoliner, cruising at a 17,000-ft. altitude, with the help of a fast tail wind reached a speed of 387 m.p.h.

September 28. The Defense Commission, over the signature of Dr. George J. Mead, Director of the Aeronautical Section, sent out letters to all airplane manufacturers engaged in the defense program, informing them that they cannot accept orders for commercial transport planes without the approval of that group. The Army and Navy are to receive priority, with machines for Great Britain in a special class.

September 29. Advisory group of twenty representatives from various sections of the aviation industry named by Civil Aeronautics Administration.

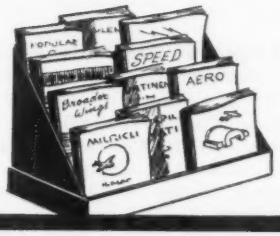
September 29. Miss Betsy Ross set the first altitude record for light airplanes. She flew a Taylorcraft equipped with a high altitude carburetor, and reached an altitude of 18,200 feet.

September 29. The War Department announced the award of a $99,641,880 contract to The Glenn L. Martin Company, of Baltimore, for the manufacture of airplanes.

September 29. A list of the New York airport projects to be constructed by the WPA was submitted to the House Appropriations Committee by the Civil Aeronautics Authority. The Air Defense Program calls for the construction of 150 landing fields in the State of New York. It was recommended that the WPA would supply the labor and materials to construct the fields, while the counties would supply the grading and equipment.

September 29. President Roosevelt laid the cornerstone of the Administration Building at the dedication of Washington's newest airport at Gravelly Point.

September 30. New York State is establishing eight industrial schools for the training of 25,000 semi-skilled workers to meet the shortage of such workers in New York State aircraft industry.



Periodicals

The reviews in these pages reflect the statements and opinions of the authors of the articles reviewed, and are not to be taken as editorial expressions of the Aeronautical Review.

Aerodynamics

Applied Aircraft Aerodynamics. Raoul J. Hoffman. An elementary outline of the subject, without formulae. *Flying and Popular Aviation*, October, 1940, pages 53, 78, 16 illus.

Air Forces on Radial Air-Cooled Engine Cowling. R. R. Higginbotham, Republic Aviation Corp. Some of the factors influencing engine cowl surface pressures are discussed. Pressure tests in a wind tunnel and on three representative cowls during actual flight are presented and summarized. From this study, methods are suggested for applying pressure-distribution data to the stress analysis of other cowls. The flight-test data are taken from reports of the United Aircraft Corp.

Continued increase in air speeds, and the severity of tactical maneuvers of military planes have combined to raise considerably the aerodynamic forces acting upon the cowling. Hence the imperative need to be able to calculate these loads and provide for them in design, particularly in planes that are required to dive at terminal velocity. *S.A.E. Journal*, September, 1940, pages 370–396, 25 illus.

Longitudinal Stability and Control. S. B. Gates. This is a description of the main features of the subject, omitting the mathematical formulas that make it so formidable to those not accustomed to them through constant use. Within these limitations it is a thorough analysis of stability and control, calculated to aid designers and others in obtaining a clear picture of what is being done and why, leaving the calculations to be handled by those directly concerned with a particular design problem.

Of several points of attack that are available, the author chose to start from the conception of the neutral point, and base his whole description upon the displacement of the center of gravity to one side or another of that point. The neutral point is defined as "that point on the wing chord the pitching moment coefficient about which does not change when the incidence changes." *Aircraft Engineering*, September, 1940, pages 260–263, 4 illus.

Helicopter Theory. Th. Kármán. A paper whose chief interest is historical, since it is a translation by the British Air Ministry of the original which appeared in the "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Vol. 12, No. 24, 1921. It did not receive due attention at the time it appeared and will be of interest to those now concerned with the subject. *Aircraft Engineering*, September, 1940, pages 271–276, 8 illus.

Accidents

Regarding Accidents. Review of statistics of accidents occurring during the 1939–1940 college training period, as released by Grove Webster, chief of the Civilian Pilot Training Program. Most accidents occurred during landings and take-offs. *Sportsman Pilot*, September 15, 1940, pages 29–31.

Recent Official Accident Reports. Digests of 27 accidents, including probable causes, and pertinent observations. *Sportsman Pilot*, September 15, 1940, pages 31–32, 35–36, 48–50.

Air Transport

Air Lines in War. A summary of the present status of air transport operations in various parts of the world, particularly those affected by hostilities. *The Aeroplane*, August, 1940, page 238, 1 illus.

Airport Traffic Control Biggest Safety Problem. Jerome Lederer. This is an informal attempt to answer the question: "What are the outstanding safety problems facing aviation?" It is stated that the foremost safety problem today is traffic control at airports, which is associated with traffic congestion. Provision of more airports is the answer to congestion. Recommendations are made for improvements in control, and there are other suggestions concerning various phases of aircraft operation. *American Aviation*, September 1, 1940, pages 8, 14.

I Cover the Hemisphere. Joseph S. Edgerton, The Evening Star, Washington, D.C. In four weeks this newspaperman flew for his paper from Fairbanks, Alaska, to Buenos Aires, Argentina, using commercial airlines. He reports his experiences and observations. *National Aeronautics*, October, 1940, pages 16–17, 2 illus.

I Learned About Flying from That! Wayne F. Lansing. Account of experiences in flying heavy freight from Tegucigalpa, Honduras, to the Agua Fria mine. *Flying and Popular Aviation*, October, 1940, pages 31, 80, 2 illus.

Terminal Traffic. Captain Fred Smith, Canadian Colonial Airlines. The large increase in air transport traffic has brought a new type of problem to the airline operator—congestion at the airports, and even some amount of flight interference along the route. Instead of one joint terminal, several local airports are needed to get passengers on the ground when heavy schedules cause delay. *Aero Digest*, October, 1940, pages 48, 126, 1 illus.

Commercial Oversea Aviation Routes. Captain G. S. Bryan, U.S.N. While international air routes over the seas have been reduced considerably due to the war, they are still being given careful study, and plans are being developed in all countries for a resumption of activities on an increased scale when hostilities end. Captain Bryan proceeds on the assumption that in order to lessen fuel loads and thus increase pay loads, the commercial airlines will, so far as possible, make use of islands as intermediate re-fuelling stations. On that basis, he lays out possible or probable routes across all the oceans, including both polar regions, with comments on weather and other conditions. *U.S. Naval Institute Proceedings*, October, 1940, pages 1427–1442, 7 charts, 4 photos.

Spanish-Iberia Air Line Co. Reorganized. Translation of law grant-

ing monopoly in air transport of passengers, mail and freight between Spain and Iberia. *Aeronautical World News*, September 15, 1940, pages 529–532.

Flying Frontier. Edward Lawson. Alaska is woefully lacking in aviation facilities, and needs them greatly in order to assist in the development of its natural resources. It is an important defense outpost of the United States and military and naval air bases should be provided. *Flying and Popular Aviation*, September, 1940, pages 16–18, 70, 72, 6 illus.

Service up the River. George R. Reiss. Few people would expect to find a busy amphibian air transport service operating on the western edge of the Alleghenies, yet such an enterprise is conducted in western Pennsylvania, northern West Virginia and southeastern Ohio. The territory has many rivers, and is served by the Pittsburgh Institute of Aeronautics, whose planes carry passengers and freight. *Flying and Popular Aviation*, September, 1940, pages 19–20, 3 illus.

Airplane Descriptions

The Fairey Albacore. Summary of construction and performance of this new plane, used by the Fleet Air Arm. *Aeronautics*, September, 1940, page 45, 2 illus.

Training Aircraft. The R.A.F. training program is reviewed briefly, followed by descriptions of the trainers used, which are classified as light, advanced, and twin-engined. Both monoplanes and biplanes are employed. *Aeronautics*, September, 1940, pages 30–33, 8 illus.

The Sportsman Test Pilot. James B. Taylor, Jr. Report of an examination and a flight in a twin-engined Cessna T50, with comments on design, construction and performance. *Sportsman Pilot*, September 15, 1940, pages 14, 15, 26, 4 illus.

The Vickers-Supermarine Spitfire. Many interesting details are given of the gradual evolution of various types of Supermarine airplanes until the Spitfire itself appeared. Details of its construction and performance are provided. *Flight*, September 26, 1940, pages a–f, 17 illus.

This Is the Spitfire. "Indicator." An excellent report on Spitfire performance, by a pilot who has flown one. *Flight*, September 26, 1940, pages 247–250, 6 illus.

British Hurricane. A full-page sectional drawing showing the construction of this famous fighter. *Scientific American*, September, 1940, page 116, 1 illus.

The Hawker Hurricane. This single-seater has seen more action in the war than any other R.A.F. machine, and is credited with having shot down more enemy airplanes than any other. Its evolution is given by describing its predecessors and prototypes, and its principal specifications and characteristics tabulated. The plane in its present form is well described. *The Aeroplane*, September 6, 1940, pages 254–264, 38 illus.

Development in Germany. Brief reports of the activities of the leading German factories and designers, as received in England. A few details are given of some new planes that may put in an appearance at some time in the future. Factories included are: Dornier, Focke-Wulf (whose Fw.198 has not proved as successful as had been expected), Heinkel, Henschel, Messerschmitt, Junkers, Blohm and Voss. *The Aeroplane*, August 30, 1940, pages 236–237, 1 illus.

The Lockheed Fighter. Brief details of the Lockheed P.38 as purchased by England, with a few specifications and figures on performance. *The Aeroplane*, August 30, 1940, page 237, 2 illus.

The Latest Deck-Lander. Short description of the Vought-Sikorsky XF4U-1, developed for the U.S. Navy. *Flight*, September 19, 1940, page 233, 1 illus.

1941 Luscombe. Description of the new Luscombe all-metal trainer with 65 hp. engine, cruising at 102 m.p.h., landing at 35 m.p.h. *Aviation*, October, 1940, pages 60, 106, 4 illus.

"Owl Plane" Can't Spin or Stall. Short description of the Ercoupe. *Popular Science*, October, 1940, page 95, 3 illus.

Swallow Low-Wing Trainer. Description of Swallow Model LT.65, a low-wing, 2-place tandem plane with 65 hp. engine. *Aero Digest*, October, 1940, page 113, 2 illus.

The Monocoupe "Zephyr." The new machine is powered by two inverted in-line Menasco D4S supercharged engines, rated at 150 hp. The same ship when powered by two Lambert radial engines is known as the Zenith. Numerous details of design and construction are given. The craft is designed both for private use, and as an intermediate trainer for the military forces. *Aero Digest*, October, 1940, pages 75, 128, 5 illus.

The Long-Nose "Blenheim." Harry Thorell. Short description of this British medium bomber. *U.S. Air Services*, October, 1940, page 21, 1 illus.

The Fairey Fulmar. Short description of this new plane, now going into service for England with the Fleet Air Arm. The two-seater fighter was developed from the 1937 Fairey P.4/34, which is illustrated. *The Aeroplane*, September 13, 1940, page 281, 1 illus.

Floating Wing Tips Give Added Safety to Light Plane. Brief description of new plane designed by Emil Doehler, with free-floating wing tips and air brakes at the tail to reduce flying speed. *Popular Science*, November, 1940, page 92, 4 illus.

Airports

N.A.A. Looks for the Facts. Kendall K. Hoyt, National Aeronautic Association. A summary of the present-day airport situation, with facts and figures as to number, investment, facilities, and needs. Similar information is given for pilot training. *National Aeronautics*, October, 1940, pages 10–12, 1 illus.

Building a Hangar with Limited Funds. G. Holmes Hansen. A report of construction of a hangar at the Waukegan, Ill., airport at a cash outlay of $987. The building will accommodate five light airplanes. A student who was a carpenter supervised construction, and other students did the work, receiving flying time in exchange. *Aero Digest*, October, 1940, pages 83–84, 5 illus.

Lisbon—Europe's Airport. (Reprinted from *Industria Portuguesa.*) A description of the facilities at the Lisbon airport and the improvements being made there. *Revista do Ar* (Portugal), July, 1940, page 26.

$200,000,000 Worth of Airports. Summary of accomplishments to date of the WPA program of airport construction. *Western Flying*, September, 1940, pages 18–20, 3 illus.

Airways at Your Service. R. E. Sturtevant. Account of airway traffic control and its advantages for the private owner. *Western Flying*, September, 1940, pages 12–14, 24, 7 illus.

Aviation Parks. Robert H. Hinckley, U.S. Assistant Secretary of Commerce. Due to the swiftly-increasing numbers of civilian pilots, the demand is growing for conveniently-located places for their activities. It is stated that cities which provide "aviation parks" for them will not only aid the National Defense program, but also reap profits. Other sports may for a time be combined with aviation activities at such centers, to help pay their costs. *National Aeronautics*, October, 1940, page 19, 1 illus.

Armament

We Must Have Air Cannon! Arch Whitehouse. A brief history of the use of the larger calibers in air fighting, with insistence upon their employment in American craft. Air cannon range from 20 to 37 mm. in caliber, and are automatic firearms. The machine gun using rifle cartridges is not as effective today as it once was, due to the use of all-metal planes, some of which are vulnerable to the machine gun bullet in only one-fifth of their area. The author concludes that the air cannon are necessary to completely arm modern bombers and fighters. A table of today's aircraft weapons is given. *Air Trails*, September, 1940, pages 20–21, 53–55, 7 illus.

Aerial Ballistics for Bomb Sighters. Tenente Aviador Mario Telo Polleri. Continuation of a series on this subject, the present article making recommendations for pursuing the study of aerial bomb trajectories. *Revista do Ar* (Portugal), July, 1940, page 17.

Biography

Phil Johnson. Short account of the life of the president of the Boeing Aircraft Company. *Western Flying*, September, 1940, page 21, 1 illus.

Sir Archibald Sinclair. Biographical sketch of the British Secretary of State for Air. *Aeronautics*, September, 1940, page 53, 1 illus.

Guy W. Vaughan. Article headed "Goal: American Air Supremacy" is an account of the career and ideals of Guy W. Vaughan, president of Curtiss-Wright Corp. and Wright Aeronautical Corp. *National Aeronautics*, October, 1940, pages 8–9, 1 illus.

Edward V. Rickenbacker. A pictorial presentation of his career. *Popular Science*, October, 1940, pages 86–87, 9 illus.

Airman-Journalist. Jack Stark. A biographical sketch of Leland Jamieson. *Flying and Popular Aviation*, October, 1940, pages 29, 30, 81, 3 illus.

Modern Veteran. George R. Feiss. Outline of the career of Richard H. Depew, Jr., of the Taylorcraft Aviation Corp. *Flying and Popular Aviation*, October, 1940, pages 45, 46, 70, 72, 1 illus.

Aviation's Apostle. Richard Martin. Outline of the career of Roger Q. Williams. *Flying and Popular Aviation*, October, 1940, pages 37, 72, 74, 2 illus.

Wellwood E. Beall. Victor Shawe. The career of the designer of the Boeing 314 Pan American Clipper. *U.S. Air Services*, October, 1940, pages 23–24, 1 illus.

"Photo by Groenhoff." E. Jay Doherty. Biography of the well-known aviation photographer, with stories of his work and reproductions of some of his pictures. *Flying and Popular Aviation*, October, 1940, pages 24, 25, 66, 68, 7 illus.

The Last Man Club. James Bassett, Jr. Stories of some of the Early Birds especially Bud Morriss. *Flying and Popular Aviation*, September, 1940, pages 30–32, 6 illus.

Companies

Wasp's Nest. Survey of the past and present of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation. *Western Flying*, September, 1940, pages 22, 23, 3 illus.

Fifteen Years of Fairchild Progress. A survey of the history and development of the Fairchild Engine & Airplane Corp. from the beginning to the present day. *Aero Digest*, October, 1940, pages 141–142, 206, 11 illus.

Design

Design for Take-Off. Brian Worley. When a plane must be designed in part for take-offs in limited space, other factors of performance must be affected to some extent. Because of this, there is a decided tendency to relax take-off and landing requirements for military planes in order to obtain maximum performance in the air. This article studies the question from the engineer's viewpoint. *Aeronautics*, September, 1940, pages 34–37, 8 charts.

Aviation Sketch Book of Design Material. Perspective drawings of aircraft parts, with short captions. Shows: Fowler flaps used in Lockheed transports and Hudson bombers; Douglas DC.3 flaps; engine mount of the Stuka Junkers Ju.87; rib construction of Douglas B.19; leading edge of the B.19. *Aviation*, October, 1940, pages 56–57, 5 illus.

Engineering Fairchild's PT.19. Armand Thieblot. A discussion of the engineering considerations leading to the design of this plane, which is a primary military trainer and has plywood wings. *Aero Digest*, October, 1940, pages 130–132, 134, 137, 16 illus.

Work of the Loft in an Aircraft Plant. Francis M. Gibian, Northrop Aircraft, Inc. An explanation of the modern method of laying out templates, mockups and full scale contours in that part of the designing process carried on in the loft. *Aero Digest*, October, 1940, pages 76, 79, 4 illus.

Design and Shop Problems in High-Pressure Hydraulic Systems. Harold W. Adams, Douglas Aircraft Co High pressures are employed in aircraft hydraulic systems because they weigh less than systems using lower pressures. The design problem is mainly one calling for care and thoroughness, except for the pumps, which present their own difficulties. Properly-designed high-pressure systems present no serious shop problems and in fact have some advantages, which are stated. *S.A.E. Journal*, September, 1940, pages 367–369, 3 illus.

Engines

Oxygen Boosting of Airplane Diesel Engines. P. H. Schweitzer, Pennsylvania State College. A report of experiments to determine the possibilities and effects of increasing the oxygen concentration in the air intake of a Diesel. It is stated that the main question was not whether the engine would respond to increased oxygen, but whether it would stand it, and that the experiments provided a favorable answer.

A $3^1/_4 \times 4^1/_2$ single-cylinder four-cycle C.F.R. engine was used. By increasing the oxygen concentration from the normal 21% to 45%, the i.hp. increased from 4.3 to 6, b.hp. from 2.9 to 4.65, maximum cylinder pressure from 700 to 780 lbs. per sq. in., while the maximum rate of pressure rise, which is an index of the shock-loading of the engine, decreased from 88 to 60 lbs. per sq. in. per degree. The ignition lag was also shortened from $9^1/_2$ to 5 degrees. *Mechanical Engineering*, October, 1940, pages 719–722, 14 illus.

Altitude and the Aircraft Engine. Erold F. Pierce, Wright Aeronautical Corp. It is pointed out that problems of engine design and performance seem to be, to the engine maker at least, more difficult for high-altitude operation than the problems met by the rest of the airplane. An aircraft engine, for example, that weighs one pound per hp. at sea level may have its output so reduced at 20,000 feet as to weigh two pounds per hp. there unless the greatest engineering skill and ingenuity are applied to increasing altitude output. To give a clearer understanding of the problems involved, empirical methods of portraying engine characteristics are summarized, the effects of various supercharging methods are illustrated, and the basic problems and trends of investigation are discussed.

The author states that a great

difficulty encountered in developing means of increasing power and economy is due to the lack of suitable flight-test facilities, as well as of time. The capital expense necessary to provide one or more planes suitable for testing modern engines in flight "is almost beyond the range of possibility." Further, the period of months required to obtain information on a given engine type seems impractical when "the same time interval could produce several new types of engines or methods of attack on a specific problem. Despite all this, the present performance of the aircraft engine at altitude is something to be proud of." *S.A.E. Journal*, October, 1940, pages 421–431, 14 illus.

The Problem of Valve-Stem and Valve-Head Deposits. A. T. Colwell, Thompson Products, Inc. Deposits on valve stems are causing slightly more than 50 percent of the engine trouble in the aviation field, according to Mr. Colwell, who asks that more attention be given to the problem of varnish and lacquer deposits on stems. Valve deposits are divided into six classifications according to nature and location. The fact that any oil will oxidize at some temperature and that such a temperature is likely to be found along a valve stem makes the problem difficult. Oils with good oxidation resistance at high temperatures cause the least difficulty. The designer attempts to get a temperature at the top of the guide that will not cause oil decomposition, or to meter the oil so that not enough deposit is formed to cause difficulty between overhauls, or to find some way to remove the deposit as it is formed. A number of aircraft remedies for valve deposits are presented and discussed. *S.A.E. Journal*, September, 1940, pages 358–365, 24 illus.

Piston Rings and Gudgeon Pins. J. A. Oates. Description of manufacture and test operations in the plant of Hepworth & Grandage, Ltd. *Aircraft Production*, September, 1940, pages 285–290, 21 illus.

Mercedes-Benz Model DB.601. Paul. H. Wilkinson. Description of one of the best-known military engines in Europe which is used in large numbers of Heinkel bombers and Messerschmitt fighters. *Aviation*, October, 1940, pages 61, 94, 1 illus.

Supercharged Ignition for Airplanes. Note on the practice of passing filtered air through the ignition cables to lessen corrosion due to moisture and gases of combustion. *Popular Science*, October, 1940, page 98, 2 illus.

130-Pound Airplane Engine Delivers 75 Horsepower. Picture and brief description of a double-opposed engine built by a California inventor. *Popular Mechanics*, November, 1940, page 656, 1 illus.

Barrel-Type Engine Tested. Illustrations with caption showing new 3-cylinder engine designed by Lee Oldfield and developed by John E. Hogle which uses a wobble-plate for transmission of power. Has been tested on a Piper Cub. *Flying and Popular Aviation*, September, 1940, page 14, 2 illus.

Lightweight Plane Motor Has Few Parts. Short notice of new engine, apparently 2-cycle, built by Victor and Charles A. Toce. *Popular Science*, September, 1940, page 80, 1 illus.

Lightweight Diesel for Airplanes Has High Cruising Range. Picture of the engine designed by S. A. Guiberson, Jr., which has been approved by the C.A.A. A test flight indicated that this 310 hp. engine could take an airplane to 21,000 feet, while the same airplane had a ceiling of 17,000 feet with a gasoline engine. *Popular Mechanics*, September, 1940, page 407, 2 illus.

Steam Power in the Air. Recommends continued exploration of the possibilities of steam for aircraft propulsion, already being investigated in a limited way in England and Germany. *Steam Car Developments and Steam Aviation*, June–July, 1940, pages 283–285, 1 illus.

Financial

Where Are Those Profits? Labor, materials, and engineering absorb largest part of the avaiation manufacturer's dollar. "Huge profits" are mostly mythical. Analysis of financial aspects of the Boeing Aircraft Company and the Beech Aircraft Company, emphasizing nation-wide distribution of money paid for airplanes, due to manufacture of parts and materials in many states. *Aviation*, October, 1940, pages 32–33, 104–106, 2 maps, 1 illus.

Fuels and Lubricants

Oil for Troubled Waters. Ensign Hobart Key, Jr., U.S. Naval Res. An article contending that the oil reserves set aside by Congress for the use of the Navy are inadequate. Details of total estimated oil supplies, drilling, geology, and costs. It is stated that within 60 years our national petroleum reserves will be exhausted. *U.S. Naval Institute Proceedings*, September, 1940, pages 1245–1260, 13 illus.

Better Fuels for Better Engines. William H. Hubner, Ethyl Gasoline Corp. A paper reviewing the refiner's solution to the problems presented by the need to produce large quantities of gasoline that will give satisfaction when used in engines under widely different driving conditions. Volatility, anti-knock quality, sulphur content, gum and chemical composition are discussed. It is suggested that the engines of the future will be smaller for a given power output, will have higher compressions, and need fuels with higher anti-knock ratings.

While aimed chiefly at engineers interested in fuels for highway vehicles, the paper presents many general considerations of value to all who are concerned with fuels for internal combustion engines for any purpose, including aviation. *S.A.E. Journal*, October, 1940, pages 409–420, 5 illus., 2 tables.

Aero Fuels of Today and Tomorrow. B. Orchard Lisle. Analysis of gasoline, qualities, sources, availability, and future prospects. *Flying and Popular Aviation*, October, 1940, pages 49, 50, 76, 3 illus., 1 table.

What Is "Octane?" B. Orchard Lisle. An account of the development and usefulness of the octane number method of rating gasoline. *Flying and Popular Aviation*, September, 1940, pages 35, 62, 64, 1 illus.

Factory Equipment

Remote Control for a 1500-Ton Press. Brief description of a new press for swaging forgings from large-section aluminum alloy bars. *Aircraft Production*, September, 1940, page 290, 1 illus.

Machine Tools and the Aircraft Industry. A survey of the machines required for the production of cylinder blocks, crankcases, pistons, crankshafts, camshafts, connecting rods, gears, propeller blades, cylinders, and heads. The equipment needed for the manufacture of each part is listed. *Aeronautics*, September, 1940, pages 73–74, 76, 8 illus.

Canteens in Factories. Description and plan of a cafeteria for a factory employing 4000 people. The kitchen is electric. *Aircraft Production*, September, 1940, pages 283, 284, 4 illus.

Modern Machine Tools. Presentation of new items of factory equipment available in England, such as band saws, vertical millers, profilers, cutters, and slotting machines. *Aircraft Production*, September, 1940, pages 304–306, 8 illus.

Wing Spar Equipment. The wing spar, due to its length and straight line design, is highly adaptable to mass-production manufacture, and several English manufacturers of machine tools have developed special machines for processing spars. Descriptions are given of several of these, including the Asquith milling machine, capable of taking spars up to 39 feet long; the Wadkin miller; the Hey machine for milling, drilling and boring; and the E.M.B. riveting machine for spars up to 24 feet in length. *Aircraft Production*, September, 1940, pages 296–299, 9 illus.

Drilling Square Holes. Brief description of the Schroeder machine used by the Germans for this purpose. The square hole is generated by means of cycloidal curves originated by rolling two gears inside or outside a third. The machine, used in Germany for machining square holes in superchargers, has an internal bevel gear drive with an inclined axis. *Aircraft Production*, September, 1940, page 299, 2 illus.

Old Equipment No Bar to Carbides for Steel Cutting. James R. Longwell, Carboloy Co., Inc. With a few qualifications, present-day machines can use cemented carbide tools, thus increasing output. To enable equipment to be checked for its availability for carbide tools, the essential requirements are outlined under the heads of power, power transmission, centers, spindles, tool posts and holders, chip room and back-lash. *Aero Digest*, October, 1940, page 125, 1 illus., 1 table.

Flight Testing

New War Planes Get Third Degree. Compact presentation of a few tails of flight testing of new military aircraft. *Popular Science*, October, 1940, pages 96–97, 7 illus.

Winged Daredevils of Science. Perilous work of test pilots described. *Popular Mechanics*, October, 1940, pages 514–517, 132A, 9 illus.

Multiple Stooge. Kurt Rand. Description of a steel-tape recorder developed by Herman S. Heller for making 16 simultaneous records of voice, noise, vibration, etc., during test flights. *Flying and Popular Aviation*, October, 1940, pages 35, 36, 4 illus.

Electric Eyes Clock Plane in New Timing Device. Short description of a photo-electric device for timing flight. *Popular Science*, November, 1940, page 90, 2 illus.

Gliding and Soaring

Gliding and Soaring. Alexis Dawydoff. Report of the Third Annual Southwestern Soaring Contest, held at Wichita Falls, June 2 to 16. *Air Trails*, September, 1940, pages 24, 64, 3 illus.

German Aerial Troop Trailers. W. S. Shackelton. Speculative discussion of the rumor that Germany is planning to carry troops in gliders towed by Junkers transport planes. Analysis of the possibilities, based on known plane and glider performance, with suggested plan for a 20-seat aerial trailer, four of which might be towed by a Junkers Ju.52/3m. *The Aeroplane*, September 6, 1940, pages 271–274, 5 illus.

Schweizer 2-Place All-Metal Sailplane. This is stated to be the first 2-place all-metal sailplane to receive C.A.A. approval in the form of a type certificate. Its design and construction are described. *Aero Digest*, October, 1940, pages 114, 128, 4 illus.

High Altitude Flight

High-Pressure Flying. Ross L. Cunningham. Boeing sealed-cabin ships are designed for passenger flights at altitudes between 15,000 and 20,000 feet. The article describes the methods of maintaining pressure in the Boeing Stratoliner and the advantages to airline and passenger of travel at high altitudes. *Flying and Popular Aviation*, September, 1940, pages 12–14, 6 illus.

Engineering for the Higher Altitudes. Wellwood E. Beall, Boeing Aircraft Co. Boeing's Mechanical Equipment Unit is a division of the Engineering Department, and is responsible for research and development of cabin-supercharging equipment, heating and ventilating systems, and hydraulic equipment for large planes. Its work is described, and some details given of medical and other considerations that have to be taken into account. A "Strato-Chamber" is used in the laboratory to simulate conditions within a cabin during flights at high altitudes, and its equipment is described as well as that in the Boeing Stratoliner. *Aero Digest*, October, 1940, pages 52–56, 10 illus.

History

Flying, as It Was. Samuel T. Payne. An account of early Glenn Curtiss days, by a draftsman and artist who has been with the Curtiss Company since 1915 and has prepared many conceptions, patent drawings, and similar graphic presentations of Curtiss types of airplanes. *Sportsman Pilot*, September 15, 1940, pages 16, 17, 26, 27.

Early Flying in British Columbia. Frank H. Ellis. Details of the first flights by a Canadian, William M. Stark, at Vancouver in 1912. *Canadian Aviation*, September, 1940, pages 38, 40, 4 illus.

Leonardo da Vinci—Aeronautical Engineer. Charles Millington, New York Museum of Science and Industry. A review of da Vinci's studies and theories of flight. Though he designed an "aerial screw," he considered that a flying machine must flap its wings like a bird. *National Aeronautics*, October, 1940, pages 22, 30, 2 illus.

Contributions to the History of Portuguese Aviation. Capitan Aviador Edgar Cardoso. An outline of the history of aviation in Portugal since 1917. *Revista do Ar* (Portugal), July, 1940, pages 8–10.

Instruction

R.C.A.F. Technical Training at St. Thomas. This school trains engine mechanics, frame mechanics, instrument makers and electricians during a six-months' course. A syllabus of subjects studied in each specialty is given. *Canadian Aviation*, September, 1940, pages 15–17, 36, 4 illus.

Safe Training Pays Dividends. Stephen Bates. The Dewey Eldred Flying Service at Cleveland and Willoughby, Ohio, pays its instructors a bonus of $50 for completing the instruction of a class without accident. *Flying and Popular Aviation*, October, 1940, pages 46, 74, 1 illus.

Are You Qualified? Hurd Barrett. Factories need engineers, draftsmen, and mechanics, but cannot take men without previous experience either in the aircraft or other industries. Review of methods of obtaining training and getting jobs. *Flying and Popular Aviation*, October, 1940, pages 32–34, 88, 5 illus.

Factory Training in the East. Carl Norcross. Aviation defense programs call for tripling plant capacity, quintupling workers. Enough experienced men are not available. Employment managers now seek two types: men with related skills who can be fitted into aircraft factory work without too much difficulty, and beginners whose elementary training and school work makes it possible to develop them with some assurance of success. Reports of personnel programs at Republic, Grumman, Brewster, Wright, Pratt & Whitney, Glenn L. Martin, Curtiss. *Aviation*, October, 1940, pages 34–35, 100, 126, 3 illus.

American Airlines Trains Its Rookies. Outlines of the extremely varied training activities of this airline, which maintains schools for practically every type of employee. *Aviation*, October, 1940, pages 44–45, 126, 5 illus.

Training Flying Cadets at Civilian Schools. T. Claude Ryan. Description of the pilot training program with special reference to its development at the Ryan School of Aeronautics. *Aviation*, October, 1940, pages 53, 124, 3 illus.

80,000 Fledglings for Defense. A survey of the C.A.B. program for training pilots and mechanics for defense forces. It is expected that some 80,000 civilian pilots will have completed their training by the end of next June; many of these will be qualified to take the Army and Navy training courses. *Popular Mechanics*, November, 1940, pages 641–645, 147A–148A, 12 illus.

Preparing for the Aeronautical Occupations. T. Lee, Jr., Boeing School of Aeronautics. Emphasizes aviation's need for trained mechanics in factory and field. It is stated that the greatest need at the present time is for riveters and sheet metal workers. The function of commercial schools is described with relation to this problem. *National Aeronautics*, October, 1940, pages 13–15, 9 illus.

The Puzzling Turn. John R. Hoyt. A C.A.A. inspector analyzes forces acting upon an airplane in steep turns. He points out that in a steep bank a great deal of lift is lost and many times the lift of normal flight is required. *Flying and Popular Aviation*, September, 1940, pages 33–34, 90, 4 illus.

India's New Air Force. Short description of plan for training pilots in India. *Indian Aviation*, June, 1940, pages 141, 142.

How Airline Captains Are Made. Description of the methods of slection and training of pilots for the airlines, largely drawn from American Airlines practice. *Popular Science*, October, 1940, pages 90–93, 14 illus.

"Tricycle" Trains Army Bombers. Note on the use of a 3-wheeled platform bearing a bomb sight, so arranged as to simulate bombing conditions. *Popular Science*, October, 1940, page 88, 1 illus.

Aeronautics in the Primary Grade Schools. Vicente Dante Luciani. The Argentine National Council on Education advocates the teaching of aeronautic subjects in the schools, and this article was broadcast as the second of a series of talks about the plan. It also discusses the part to be played by aviation in making the remoter districts more accessible to the government. *Mundo Aeronautico* (Argentine), July, 1940, pages 2–4.

Teaching Aeronautics in the Schools. Gives the text of the rules issued by the National Council on Education for instruction in aeronautics in Argentinian schools. *Mundo Aeronautico*, July, 1940, pages 18, 22.

Flyers by the Ten Thousand. John E. Lodge. Describes the college pilot training course established under the auspices of the C.A.A., with an outline of the program and figures as to the number of students, hours in the air, and other details. *Popular Science*, September, 1940, pages 46–49, 219–220, 7 illus.

Flying for College Students. Bradley Jones. A description of the civilian pilot training program of the C.A.B., with special reference to the part undertaken at the University of Cincinnati. *U.S. Air Services*, October, 1940, pages 25–26, 3 illus.

Pilots Needed! Malden G. Bishop. To man a force of 50,000 planes, at least 100,000 pilots will be required, and the methods available to develop such a number are outlined. *Flying and Popular Aviation*, October, 1940, pages 20–22, 88, 5 illus.

Jobs Which Are Required in Constructing Aircraft. A survey prepared by the Information Service, Division of Placement and Unemployment Insurance, N.Y. State Department of Labor. The various aircraft factory jobs are classified alphabetically by their titles, and the work required in each is described. *Aero Digest*, October, 1940, pages 49–51, 126, 128, 5 illus.

Instruments

Accessory Compass Drive. Description of the Bendix MN-31 automatic radio compass drive. *Aviation*, October, 1940, page 62, 1 illus.

Instrument Flying

Instrument Flying. A brief survey of the technique of flying by instruments. *Revista do Ar* (Portugal), July, 1940, page 14.

Lighter-than-Air

Balloon Flights Train Navy Airmen. Robert E. Martin. The free balloon is still considered an essential part in America's defense program. Because a blimp or airship with dead engines must be handled like a balloon, training with free balloons is part of the Navy lighter-than-air course at Lakehurst, N.J. *Popular Science*, November, 1940, pages 86–89, 10 illus.

Blimps. R. G. Picinich, Jr. Goodyear Blimps have carried 367,683 persons on 137,367 flights and flown a total distance of 3,734,129 miles. The object has been to train personnel, improve equipment and test materials. Brief history of this operation and details of present status. *Aviation*, October, 1940, pages 48–49, 120, 5 illus.

Manufacture

New Camera Drafting Process Aids in Rapid Plane Production. Engineering drawings are reproduced photographically directly upon almost any material. Process used by Glenn L. Martin Co. produces exact-scale master drawings on aluminum alloy sheets. Drawings also can be photographed onto the metal from which airplane parts are to be made. *Canadian Aviation*, September, 1940, pages 24–26, 4 illus.

Production Checks in Manufacture. Review of inspection methods used in the German Junkers factory. In addition to normal inspections, an overriding inspector follows up the various stages of manufacture. Many special gages are used for large dimensions. *Aircraft Production*, September, 1940, pages 301, 302, 6 illus.

Percussion Welding. Short resumé of this method of welding similar or dissimilar metals, using the ENV welder. *Aircraft Production*, September, 1940, page 303, 2 illus.

Background to the British Aircraft Industry. Captain Norman Macmillan. Emphasizes the fact that the airplane factories are part of but not the whole of the aviation industry, and that the industry includes a wide scope, composed not only of airplane and parts suppliers, but also producers of essential materials in all parts of the world. Unification of control of the whole group is advocated. *Aeronautics*, 1940, pages 42–45, 2 maps.

Hampdens Are Now "Made in Canada." Six Canadian companies are supplying parts and assemblies for the Handley Page Hampden Bomber, for assembly in two plants of Canadian Associated Aircraft, Ltd. Brief description of the plane. *Canadian Aviation*, September, 1940, pages 18–20, 26, 43, 7 illus.

We'll Give America Wings! Donald W. Douglas. American designers and manufacturers, if unhampered, can produce 50,000 planes a year, and make them equal or superior to those of any other country. *Liberty*, September 7, 1940, pages 57, 58, 1 illus.

Aircraft Jig Design. Description of factory procedures involving the use of jigs by Blackburn Aircraft, Ltd., in the manufacture of the Skua dive bomber. So far as possible the plane has been broken down into sub-assemblies to permit rapid manufacture, while the accuracy necessary for this system is maintained by the jig system, plus many checks and inspections. *Aircraft Production*, September, 1940, pages 277–282, 22 illus.

Jigs at Republic. Republic Aviation Corp. divides its production into as many sub-assemblies as possible, in order to use more jigs and more men, and speed output. Brief text, many pictures. *Aviation*, October, 1940, pages 36–39, 15 illus.

X-Ray Machine Speeds Up Plane Production. Employment of the X-ray to examine airplane castings for flaws, as used in the Lockheed plant. *Popular Science*, November, 1940, pages 94–95, 4 illus.

Photos Replace Airplane Plans. Notes of the camera-projection method used in the Glenn L. Martin plant to produce full-size drawings on metal. *Popular Science*, October, 1940, page 64, 3 illus.

Plane Bakery. A page of photographs, with brief text, describing the process of manufacturing the Timm airplane which uses liquid plastic material and plywood shaped by heat. *Flying and Popular Aviation*, September, 1940, page 21, 5 illus.

Huge Camera Speeds Production of Airplanes. A brief description of the advantages of the Glenn L. Martin photographic method of transferring full-size engineering drawings to metal or other materials. *Popular Mechanics*, September, 1940, page 327, 2 illus.

Building the Douglas B.19. Two pages of photographs, with captions, illustrating various phases of construction of this largest of bombers, with a wing spread of 210 feet. *Aviation*, October, 1940, pages 58–59, 7 illus.

Artificial Lighting and Eyesight. G. V. Downer. Good vision is essential not only to flying personnel, but also to factory employees, and the article considers not only the structure of the eye and the functions of its various parts, but also discusses optimum lighting, direct and indirect, the effects of color, and the causes of eyestrain. *Aircraft Engineering*, September, 1940, page 286, 1 illus.

Materials

Casein Glues. Results of a test to determine resistance of two kinds of Casco casein glues to attack by mold. *Aircraft Production*, September, 1940, page 276, 1 illus.

Aluminum and Magnesium. A brief review of alternative English sources of supply of these metals, now that bauxite shipments from France have stopped, and magnesite is difficult to get from Greece. *Aircraft Production*, September, 1940, page 300.

Woven Impregnated Wood. Properties and construction of this material, made of interwoven wood strips impregnated with plastics. *Aircraft Production*, September, 1940, page 295, 1 illus.

How the Materiel Division Tests Aircraft Finishes. Summary of tests to which finishes are subjected. *Air Corps News Letter*, September 15, 1940, pages 1, 2.

Synthetic Glues in the Aircraft Industry. John S. Trevor. By "synthetic glues" the author means thermo-setting plastics and thermoplastic cements. Details are given of their advantages, how they are employed in plywood and other construction. The great virtues of dry glue in sheet form are pointed out, while the liquid cements, recently improved, are emphasized for their complete adaptability to such work as jointing. *Aeronautics*, September, 1940, pages 43–44.

Modern Wooden Construction. A. R. Weyl. A continuation of a series of articles on the manufacture of airplanes using wood construction. This installment discusses the advantages, applications and method of use of various synthetic glues and resins. *Aircraft Engineering*, September, 1940, pages 284–285.

Permanence of the Physical Properties of Plastics. J. Delmonte. Plastics are subject to creep and cold-flow, and certain other changes in physical properties sometimes occur in use. An equation is developed for expressing the deformation rate, and experimental evidence is quoted to show that eventually the deformation rate becomes constant and continues indefinitely. Data are presented for various types of plastics. Consideration is also given to the effects of temperature and humidity. There is a bibliography, two contributed discussions, and closing remarks by the author. *Transactions of the A.S.M.E.*, August, 1940, pages 513–524, 24 illus.

The Forming of Aluminum Alloy Sheet. Notes and suggestions about some frequently ignored but important points that must be taken into account when forming high-strength aluminum alloy sheets to the profiles required in stressed surfaces for aircraft. *Aircraft Engineering*, September, 1940, pages 283, 285, 5 illus.

Fatigue Strength of Castings Improved by New Screw Thread System. Harold Caminez, Air Associates, Inc. It has been found, according to the author, that the conventional V-type threads can be a cause of fatigue failure, due to concentration of stress at the roots. The Aero-Thread system was developed to avoid this condition. It is stated that tests show prevention of fatigue-failure in screws and studs, and also an increase in the fatigue strength of aluminum alloy castings. Details of the theory and design. *Aero Digest*, October, 1940, pages 102, 105–106, 109, 12 illus.

Protection of Aircraft Plywood. Roy B. Anderson, Wipe-On Corp. A description of the finishing of the new Fairchild PT.19 with a synthetic coating. The plane has plywood wings. Results of tests are given. *Aero Digest*, October, 1940, pages 137–138, 2 illus.

Meteorology

Formation of Thunderstorms in the Alps. Filippo Eredia. A study of storms originating in the Alpine heights, their frequency, the regions in which they originate and the locations of principal storm activity. *L'Ala d'Italia* (Italy), June 1–15, 1940, pages 28–32, 4 maps, 2 illus.

An Improved Design of Cup Anemometer. P. A. Sheppard, Imperial College of Science and Technology. The new instrument employs light moving parts, their weight being only 50 grams, while the counting mechanism consists of a continuous-motion stop-watch from which the hair-spring and balance have been removed, so that the rotation of the anemometer spindle supplies a trigger action to which the watch mechanism responds under the energy of the mainspring.

Due to this combination of light-weight moving parts, and the watch movement, the instrument is exceptionally sensitive to changes in wind velocity. It is stated that it will respond satisfactorily to air movement as slow as 40 ft. per min.; that the rate of rotation of the cups is related linearly with wind velocity and consequently the indicated mean value in gusty winds is true, apart from inertia effects; the inertia is so small that there is quick response to changes; and the anemometer is portable and small in size. *Journal*

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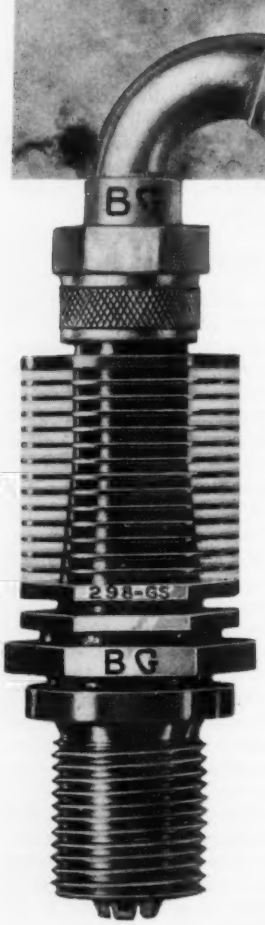

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of Scientific Instruments, September, 1940, pages 218–221, 5 illus.

What Air Means to the Airman. Assen Jordanoff. The elements of meteorology and their importance to the aviator. *Canadian Aviation*, September, 1940, pages 33–36, 4 illus.

An Automatic Weather Station. Harry Diamond and Wilbur S. Hinman, Jr. An important contribution of radio to the collection of weather data consists of the possibility of installing completely automatic stations at isolated locations, for the transmission of meteorological information at predetermined times without human intervention. An experimental installation of this type at the U.S. Naval Air Station, Anacostia, D.C., is described and its work analyzed for a 30-day period. *Journal of Research of the National Bureau of Standards*, August, 1940, pages 133–148, 14 illus.

Military Aviation

Air Expansion in Canada. For a time there seemed to be a slowing down of Canada's aviation effort, but this apparent trend has been reversed dramatically, and now the Dominion is turning out increasing numbers of planes, pilots, and mechanics. Facts and figures are given. *Flight*, September 19, 1940, pages a–b, 3 illus.

A Spitfire and a Boy. Quentin Reynolds. Account of a visit to an English fighter squadron, one of whose pilots was an American. Contains many details of squadron operation and some concerning the Spitfire. *Collier's*, September 21, 1940, pages 11, 73, 1 photo.

Substance and Shadow. J. M. Spaight. German air strength has been the subject of discussion and controversy in England for years, and still is. This article reviews the estimates made by numerous authorities in various countries, and endeavors to assess their trustworthiness, but without arriving at any definite conclusions. Losses are estimated roughly, and there is comment on the inexperience of some German pilots and crew members, but there is no attempt to estimate production. *Aeronautics*, September, 1940, pages 26–29.

L'Armée de l'Air. Comments on the French collapse with reference to that country's air strength. *Aeronautics*, September, 1940, pages 46–47, 7 illus.

The Minelayer Fleet. An account of the planes used by the British to lay mines in German waters, with some details of the special arrangements in these craft to fit them for their task, the manner in which it is carried out, and brief reports of experiences on actual flights. *The Aeroplane*, August 30, 1940, pages 226–227, 3 illus.

The Real Nazi Terror. Robert A. Winston. While dive-bombing is popularly credited with being the most effective and most terrifying of aerial attacks, the author contends that bombing from planes in level flight at high altitudes is more demoralizing because the enemy is invisible to most eyes, seldom can be hit by ground batteries, and his objectives are unknown. Because defense must be aerial, like the attack, those on the ground feel defenseless. *Flying and Popular Aviation*, October, 1940, pages 16–18, 81, 4 illus.

Speeding up National Defense. Symposium of short comments from prominent government officials and manufacturers, including William S. Knudsen, Col. Frank Knox, Guy W. Vaughan, William T. Piper, and Donald W. Douglas. *Flying and Popular Aviation*, October, 1940, pages 14, 15, 7 illus.

The Defense of America (Part 2). Cy Caldwell. France and England were prepared for the kind of war that might have been waged in 1936, but not the type that began in 1939; in other words, they did not foresee the tremendous effect of overwhelming air power. From this conclusion, lessons are drawn as to the need for adequate American air forces. It is stated that those who advocate new conceptions of the place of air power in American defense "butt up against a rubber wall of Army-Navy opposition." There is an analysis of similarities and differences between the U.S. and England, and of the objections raised in various quarters to the recommendations of air power advocates. *Aero Digest*, October, 1940, pages 38–42, 7 illus.

Air Force in Action. Composite drawing shows the various branches of the U.S. Army Air Corps in action, performing their various missions with photographs of latest types of Army airplanes. *Air Trails*, September, 1940, pages 16–17, 13 illus.

Military Perspective. James E. Fechet. After analyzing German military operations, and old concepts of warfare, the author considers the position of the airplane in American defense. *U.S. Air Services*, October, 1940, pages 13–14, 36, 1 illus.

Bombers Beware. The present American defenses against bombing are described, including anti-aircraft artillary, balloon barrages, and systems for making use of reports by observers on the ground. *Popular Science*, November, 1940, pages 60–63, 238, 7 illus.

Can Fighters Stop Bombers? John R. Hoyt. A discussion of the problems involved, such as the smallness of the sector that can be guarded by a fighter, and the number of guns mounted by bombers. It is stated that at least three fighters are needed to attack each oncoming enemy bombing plane. The conclusion of the article is that fighters cannot prevent some bombers from reaching their objectives. *Air Trails*, September, 1940, pages 14–15, 59–60, 6 illus.

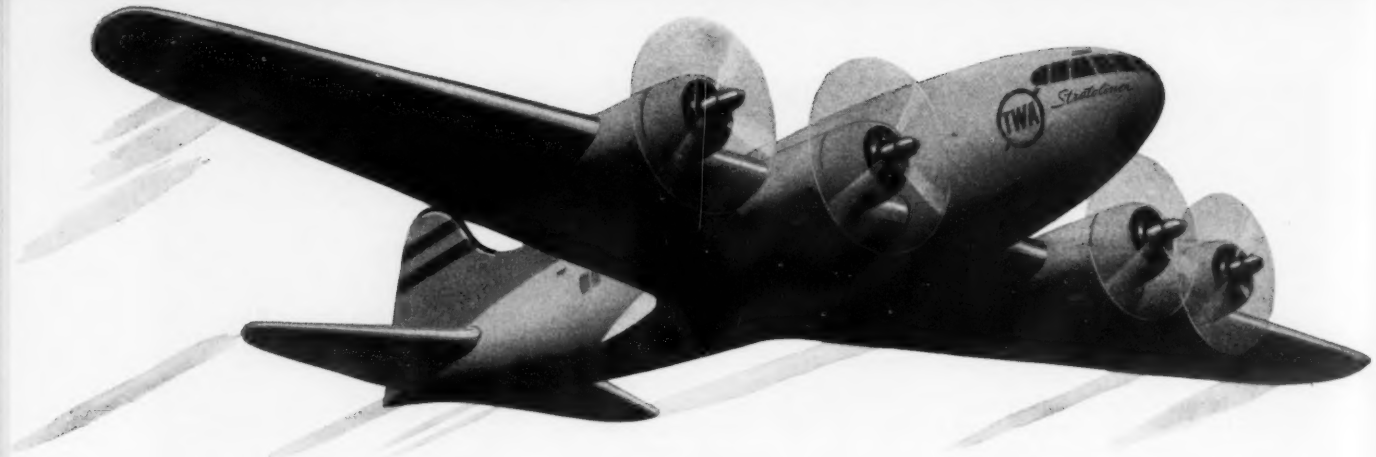
Victory and the Bombing of Hinterlands. J. M. Spaight. Comments upon the failure of both sides to bomb far back of the lines in the early days of the war, and analyzes the present situation. *Royal Air Force Quarterly*, September, 1940, pages 329–338.

Second Phase of the War: German Invasion of the Low Countries. An account of air action from the invasion of Holland and Belgium to the withdrawal from Dunkirk. *Royal Air Force Quarterly*, September, 1940, pages 384–398.

Army on the Wing. Describes the training and expansion program of the U.S. Army's Air Force. The original 29 squadrons are being increased to 45, and the skeletonized organization is to be brought up to full man-power. Some details are given of the problems encountered, and how the students are trained to be expert military aviators. Illustrated in color. *Popular Mechanics*, September, 1940, pages 337–344, 128A, 19 illus.

50,000 War Planes a Year. Captain E. V. Rickenbacker. We are far from the President's goal of fifty thousand airplanes a year, according to figures given in this article, which also discusses the types of airplanes we need, and the number of pilots required. It is estimated that 300,000 trained mechanics would be necessary to do the ground maintenance work on 50,000 airplanes, and that the aircraft factories will have to add 250,000 expert mechanics. The author recommends as part of the training and expansion program that all first-class mail that travels over 100 miles be carried by air. *Popular Mechanics*, September, 1940, pages 321–324, 132A, 134A, 10 illus.

Hitting Power. Francis Vivian Drake. After a summary of American military and naval weaknesses, the thesis is developed that the bomber is today's supreme offensive weapon, the fighter, defensive. We must therefore have large numbers of bombers, to attack possible enemy ships off our shores, possible enemy



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AGAIN... A BOEING FIRST! Continuing the ascendancy of BOEING 4-engine aircraft, which began with the development of the mighty Flying Fortresses for the U. S. Army Air Corps, BOEING now steps forth as the first airplane manufacturer to provide 4-engine commercial air transports for passenger lines encircling two-thirds of the globe. From Lisbon to Hong Kong, the new standards of luxury, speed and reliability for which BOEING 4-engine airplanes are famous are now available to air travelers. For more than a year, giant 41-ton BOEING-built Clippers have been flying the Atlantic and the Pacific on Pan American Airways' routes. Transcontinental & Western Air, Inc., recently completed the great 15,000-mile span by inaugurating 4-engine BOEING Stratoliners on their established coast-to-coast route. In addition Pan American Airways are now using BOEING 307 Strato-Clippers in intercontinental service to Rio de Janeiro.

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air bases in this hemisphere. It is stated the first 5000 such bombers could be in the air within less than a year. *The Atlantic*, October, 1940, pages 404–409.

The War in the West. Thirty photographs taken during the campaign against Holland and Belgium. The effects of aerial bombs are shown, and there are pictures of descending parachutists, and of airplanes in flight and in formation. *L'Ala d'Italia* (Italy), June 1–15, 1940, pages 5–20, 30 illus.

Air Defense of the Panama Canal. S. Caldara. How the Canal should be defended, according to the Italian view, is explained, air defense being given the chief position. A map presents the area within which airports should be located. *L'Ala d'Italia* (Italy), June 1–15, 1940, pages 21–25, 1 map.

Aviation in the Battle of Flanders. Juan Iwersen Thomas. A report from a war correspondent. Details are given of the effects of German aerial bombs upon cities in Flanders. *L'Ala d'Italia* (Italy), June 1–15, 1940, pages 26–27.

With the "Stukas" Over the North Sea. Hans Meizner. One of the members of a German bomber squadron reports on the conduct of air raids over the North Sea and along the English Channel. *L'Ala d'Italia* (Italy), June 1–15, 1940, pages 41–43.

Recommendations for the Aerial Defense of Objectives Nos. 1, 2, 3, and 4. Tenente Aviador Machado de Barros. Portugal has divided her territory into zones, according to distance from the border. Anti-aircraft defense measures for the protection of possible objectives within each zone are discussed. *Revista do Ar* (Portugal), June, 1940, pages 3–4, 2 illus.

Dive Bombing. Tenente Aviador Joaquim M. Subtil. The principles of dive bombing are studied mathematically. *Revista do Ar* (Portugal), July, 1940, pages 5–7.

Panama Is Defenseless. General William Mitchell. Reprint of the article that originally appeared in September, 1929, and still holds interest. *Flying and Popular Aviation*, September, 1940, pages 10–11, 56, 58, 74, 76, 4 illus.

Air Power Will Dominate the Pacific. General William Mitchell. Reprint of one of General Mitchell's well-known articles, originally published in 1929 and still interesting. *Flying and Popular Aviation*, October, 1940, pages 10–13, 58, 62, 80, 8 illus.

Someone's Got to Build 'Em. Alexis Dawydoff. Discussion of the possibilities of standardizing various components, concentrating on a few types of planes, and achieving a workable compromise between constant improvement and volume manufacture. *Air Trails*, September, 1940, pages 22, 58–59, 7 illus.

Canada's Warplane Industry. James Montagnes. War-time expansion of Canada's aircraft industry will make it possible to produce 360 planes a month early in 1941. Over 17,000 workers are now employed. Summaries of plant activities. *Aviation*, October, 1940, pages 31, 98, 106, 4 illus.

Research Girds for War. Part II. S. Paul Johnston, N.A.C.A. Part I of this series dealt with the N.A.C.A.; this section, with the National Defense Research Committee. Outlines its history, development, functions, and operation. *Aviation*, October, 1940, pages 40–41, 118, 4 illus.

New Tasks for War Balloons. Major William H. Wenstrom. Observation, barrage, radio-sonde, and pilot balloons are described, and their purposes and functions outlined. *Popular Mechanics*, October, 1940, pages 552–555, 130A–130B, 11 illus.

Naval Aviation

The Coast Guard in the National Defense Program. Since 1916, aviation has been a part of U.S. Coast Guard activities. Summaries of the organization's accomplishments and future plans. *U.S. Air Services*, October, 1940, page 19.

Bombers or Battleships. A presentation of the naval side of this much-discussed question, drawn from U.S. Army and Navy sources. *Popular Science*, October, 1940, pages 50–56, 228, 8 illus.

Bombers plus Battleship. Commander A. B. Vosseller, U.S.N. Controversy as to relative values and merits of bombers versus battleships is held to becloud the issue of national defense; each instrument of warfare has its place, and for adequate protection both must serve for national defense. *Scientific American*, October, 1940, pages 183–185, 3 illus.

Helldivers. James L. H. Peck. The technique of dive bombing as developed by the U.S. Navy, with brief descriptions of types of airplanes employed in this maneuver. *Scientific American*, October, 1940, pages 186–188, 3 illus.

I Flew into Battle in a British Bomber. Robert Low. A reporter's story of a flight in a Sunderland flying boat, escorting a convoy, hunting a submarine, and making a reconnaissance over the French coast, in 13 hours. One enemy aircraft is shot down. A few censor-passed details of procedure. *Liberty*, September 28, 1940, pages 29–30.

Possibilities of Large Flying Boats for National Defense. Heraclio Alfaro, Aircraft Engine Development, Inc. Suggestions for the design of a large seaplane, powered with about 28,000 hp. and having a gross weight of about 336,000 pounds. It is estimated that the first plane of this type would cost about $6,700,000, and its power plant, $4,000,000, including developmental expenses, and that it would take about two years to complete. The strategic value of a fleet of such giant seaplanes is outlined. *Aero Digest*, October, 1940, pages 43–45, 2 illus.

Bering Sea Patrol. Lieutenant W. A. Burton, U.S.C.G. Use of the airplane to patrol American waters in the Bering Sea started only recently. The author, who flew the opening patrol, writes of some of his experiences while seeking illegal salmon fishermen or seal hunters. *Air Trails*, September, 1940, pages 18–19, 56–58, 6 illus.

A Re-Examination of Mahan's Concept of Sea Power. Captain William D. Puleston, U.S.N., Ret. A study of Mahan in the light of today's developments, particularly aviation. Concludes that aviation may become our major weapon, with the fleet and the Army sustaining its operations directly and indirectly. For the present the cooperation already existing between the three forces should be maintained. *U.S. Naval Institute Proceedings*, September, 1940, pages 1229–1236.

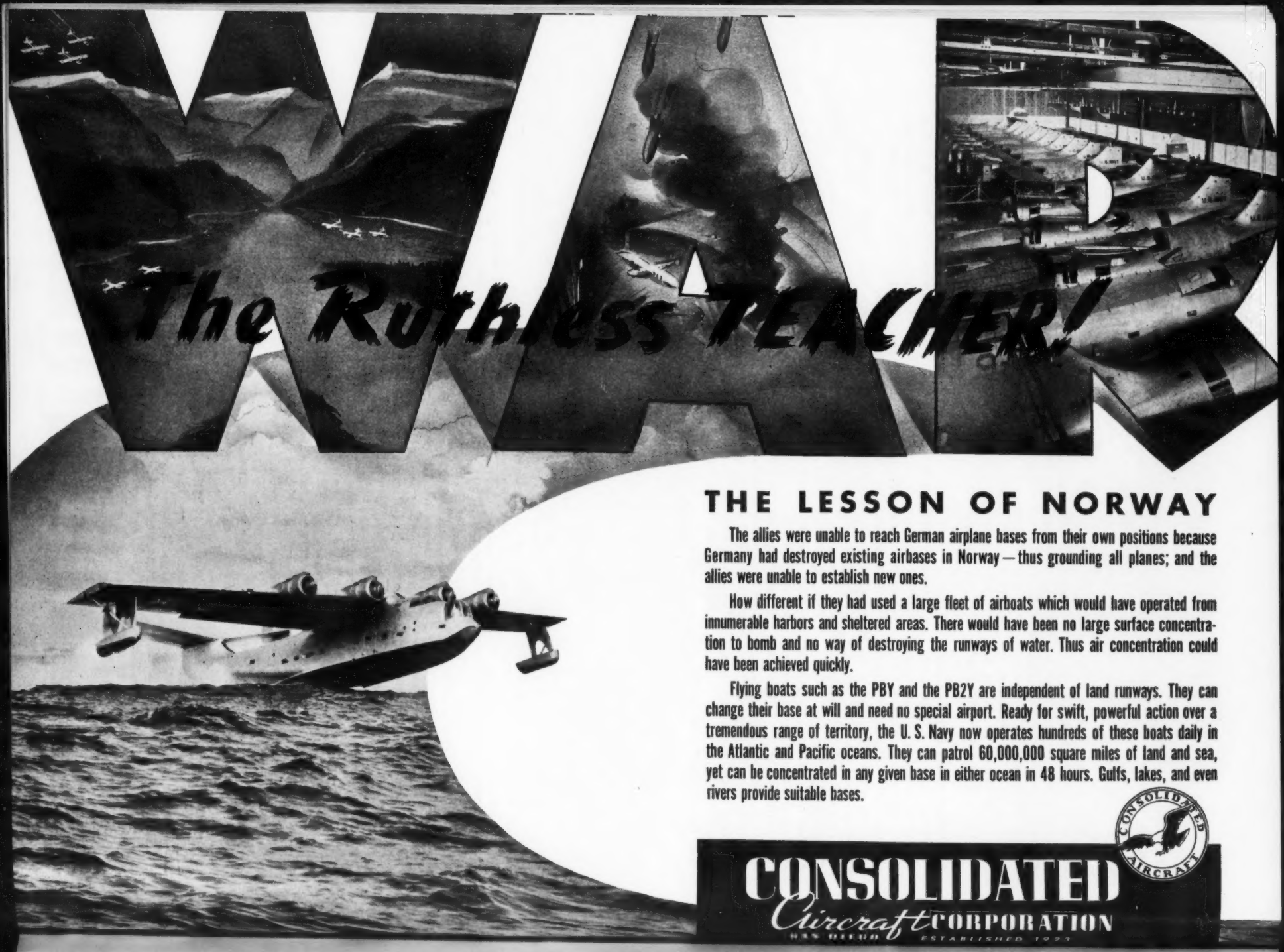
Slingshot Aviators. William Herbert Randall. Description of the procedure preliminary to catapulting a plane from a ship's deck. *Air Trails*, September, 1940, pages 19, 52, 5 illus.

Model Airplanes

"Tail First" with Gas Power. Alfred Rubin. The "canard" type model plane can be made to fly as sucessfully as the conventional kind. Center of gravity must be well forward of the wing. Design and construction explained. *Model Airplane News*, October, 1940, pages 15–17, 52, 54, 2 illus., 1 sketch, scale drawings.

A Single-Blade Free-Wheeling Prop. Donald Mertens. Advantages of this type for models and how to build and counterbalance it. *Model Airplane News*, October, 1940, pages 33, 46, 3 drawings.

A Record-Breaking Helicopter. Richard Obarski. How to duplicate a prize-winning indoor model 2-



THE LESSON OF NORWAY

The allies were unable to reach German airplane bases from their own positions because Germany had destroyed existing airbases in Norway—thus grounding all planes; and the allies were unable to establish new ones.

How different if they had used a large fleet of airboats which would have operated from innumerable harbors and sheltered areas. There would have been no large surface concentration to bomb and no way of destroying the runways of water. Thus air concentration could have been achieved quickly.

Flying boats such as the PBY and the PB2Y are independent of land runways. They can change their base at will and need no special airport. Ready for swift, powerful action over a tremendous range of territory, the U. S. Navy now operates hundreds of these boats daily in the Atlantic and Pacific oceans. They can patrol 60,000,000 square miles of land and sea, yet can be concentrated in any given base in either ocean in 48 hours. Gulfs, lakes, and even rivers provide suitable bases.

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propeller helicopter. *Model Airplane News*, October, 1940, pages 30, 31, 66, 67, 2 illus.

Seaplane Pointers. Roger F. Parkhill. Concentrates on the design and construction of floats. *Model Airplane News*, October, 1940, pages 12–14, 57–59, 5 drawings, 24 illus.

Fundamentals of Gas Model Engines. Charles Hampson Grant. Part 2. Description of carburetion and ignition systems. *Model Airplane News*, October, 1940, pages 11, 70–72, 4 illus.

Twin Motors Run Giant Model Airplane. A twin-motored model airplane. *Popular Science*, October, 1940, page 121, 2 illus.

Electric Starter Spins Model Airplane Props. Suggestion for using a re-conditioned automobile engine starter, attached to the bumper of a car, for starting model engines. *Popular Science Monthly*, September, 1940, page 188, 2 illus.

Timer Releases Pick-a-Back Models in Flight. The pick-a-back system as worked out by members of the San Antonio Gas Model Club. The smaller plane is released from the back of the larger by a timer and then flies under its own power. *Popular Mechanics*, November, 1940, page 698, 1 illus.

The Sky's the Limit. A general survey of model plane building and flying, with estimates of costs, which range from a few cents upward, and mention of the official contests that have done so much to stimulate the interest of model builders. *Popular Mechanics*, September, 1940, pages 392–394, 130A, 11 illus.

Navigation

P.A.A Is Training Navigators for Army Air Corps. Doris S. Hunt. An account of the navigation training school of Pan American Airways. U.S. Air Services, September, 1940, pages 17, 36, 1 illus.

Earth's Rotational Effect on the Bubble Sextant. Lieutenant Commander P. V. H. Weems, U.S.N. (Ret.) and Captain T. L. Thurlow, U.S. Air Corps. Development of the bubble sextant for use in aviation is well known; this article is a study of the "persistent and predictable acceleration error caused by the rotation of the earth." It has long been known that objects in motion relative to the earth are subject to an acceleration at right angles to their paths, due to the earth's rotation. This effect is noted in shell trajectories, and in such phenomena as the movement of storms and the flow of ocean currents.

A bubble sextant in use on a plane naturally is subject to such a force, and thus gives the navigator a slightly false reading of zenith or horizon. The authors calculate the amount of this error, and supply a practical application of their formulas by means of a table showing corrections to be made in readings at various latitudes and speeds. *U.S. Naval Institute Proceedings*, October, 1940, pages 1420–1423, 5 illus., 1 table.

Organizations

N.A.A. Maps New Program. The plans of the National Aeronautic Association are summarized and tabulated, under the heads of National Defense, Commerce, Industry, Education and Promotion. *National Aeronautics*, October, 1940, pages 20–21.

Flying Nurses. Description of the work of the Aerial Nurse Corps of America. This organization sends its ambulance plane to isolated sections and carries patients to hospitals that otherwise would be inaccessible to them. *Popular Mechanics*, October, 1940, pages 494–495, 6 illus.

Parachutes

American Parachutists in Forest Service. Armella C. Friedl. In 1939 the U.S. Forest Service experimented with the plane-and-parachute method of getting fire fighters to the scene of remote blazes in the woods. The work is being continued this year, and shows promising results. This is a preliminary report and account of some of the work done. *U.S. Air Services*, September, 1940, pages 12–14, 32, 2 illus.

Paratroop History. Brief outline of the development of parachute soldiers. It is not generally known that spies were occasionally landed behind enemy lines during the war of 1914–1918. Russia is given the credit for developing the idea into a successful method of landing large bodies of troops, with their equipment. *Aeronautics*, September, 1940, page 55.

The Parachuting Reds. Albert Parry. Discussion of the Soviet methods of dropping troops by parachute, and adoption of the plan by the German army. *Flying and Popular Aviation*, September, 1940, pages 28–29, 60, 62, 3 illus.

Uncle Sam Drills Parachute Troops. Description of the methods used by the U.S. Army in training parachutists. *Popular Science*, November, 1940, pages 68–69, 4 illus.

Fighting Forest Fires from the Air. A year ago the U.S. Forest Service made its first experiment with parachutes, dropping a professional jumper. After some modification of the suit, further experiments were conducted, and this method of placing fire fighters near the scene of remote forest fires has proved so promising that the work is being continued. Details of procedure, and how the fires are fought. *Popular Mechanics*, November, 1940, pages 648–651, 150A, 12 illus.

Parts and Accessories

Self-Locking Nuts. D. M. Warner. Nuts of this type are replacing the older castle-nut and cotter pin. Review of advantages, requirements, tests. *Air Corps News Letter*, September 1, 1940, pages 1, 2.

Photography

Color Joins the Army. Douglas J. Ingells. Through the use of color film, greatly improved photographic records are obtained by U.S. Army pilots. Details that are invisible or undecipherable in black and white become clear and readable in color. *Flying and Popular Aviation*, September, 1940, pages 36–37, 78, 6 illus.

India's Survey Organization. Because of the war, the work of the Air Survey of India has been reduced, intensive military training occupying much time of the personnel. About 20,000 square miles are expected to be mapped annually. *Indian Aviation*, June, 1940, pages 149, 150.

Private Flying

Greeks with Wings. Frank Cunningham. Alpha Eta Rho, the college fraternity, stimulates interest in aviation in colleges by means of flying teams in its chapters. Information as to its work and progress. *Flying and Popular Aviation*, October, 1940, pages 42–44, 5 illus.

40 Planes Started Something. Robert Kleckner. The municipal airport at West Bend, Wis., was neglected until 40 airplanes landed in a flight sponsored by the Wisconsin Civil Air Corps. This and subsequent events brought about airport improvements and stimulated nearby private flying. *Flying and Popular Aviation*, October, 1940, pages 47, 48, 2 illus.

Hangar Flying. Boone Guyton. A former Navy pilot now doing test-flying comments on visibility from the cabin of a private airplane compared with that from military craft and emphasizes need to rely upon radio instructions from the control tower when landing at a busy airport. *Sportsman Pilot*, September 15, 1940, pages 12, 13, 36.

NEW

Striking Power of the FLEET

CURTISS XSB2C-1 DIVE-BOMBER

The Curtiss XSB2C-1 Dive-Bomber, developed jointly by the United States Navy and the Curtiss Aeroplane Division, Curtiss-Wright Corporation, offers performance and versatility never heretofore achieved in aircraft of its type. In addition to armament for its own defense, this new weapon is capable of carrying increased bomb loads and heavy fire power—at high speed over a great distance—for making an attack with deadly striking power.

The XSB2C-1 is equipped with a Wright Double-Row Cyclone 14-cylinder engine. Now nearing completion, it will soon be in the hands of the Naval Trial Board and will offer new offensive power to the Navy when operated with carrier squadrons of the U. S. Fleet.

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PRECISION-BUILT ARMY AND NAVY AIRCRAFT

The Cub Flying Club Plan. Details and provisions of Piper Aircraft's plan of club ownership and operation of an airplane, which enables members to fly at cost. Suggestions are made as to methods of organizing a club, a constitution and by-laws are given, forms and records shown, and many other details of management provided. Should be helpful to all contemplating the club form of aviation activity. *Aero Digest*, October, 1940, pages 88, 90, 126, 2 illus., 1 table of rates.

Some Developments and Trends in Private Aviation. Current emphasis upon training civilian pilots has brought about changes in the original Government program of fostering private aviation. The effects of these changes are considered and recommendations made for adjustments. *Sportsman Pilot*, September 15, 1940, pages 8, 9, 41, 1 illus.

The Water's Fine! Lawrence Ward. The National Youth Administration and the Civil Aeronautics Board have been promoting the use of seaplanes by private owners. A campaign is under way to increase materially the number of available ports by constructing the necessary docks and other facilities at suitable locations. *Flying and Popular Aviation*, October, 1940, pages 40, 41, 89, 6 illus.

Seaplaning—Three Sports in One. The three sports are flying, powerboating, and sailing. Notes on the C.A.B. program of increasing the number of available ports, and comments on the advantages and problems of seaplane operation. *Popular Mechanics*, November, 1940, pages 674–677, 141A, 13 illus.

Propellers

Curtiss Propeller Production. Part II. Describes the various general departments, including details of the method of producing hollow steel blades. *Aviation*, October, 1940, pages 42–43, 110, 112, 9 illus.

Polar Diagrams for Airscrew Design. Ph. von Doepp. Translation of an article from *Luftfahrtforschung*, Vol. 13, No. 2, 1936, describing a German method, based on British experiments, for the prediction of propeller performance. *Aircraft Engineering*, September, 1940, pages 264–270, 11 illus.

Some Aspects of Airscrew Design. H. L. Milner. Higher powered motors, accompanied by increases in the speed of flight, have tended to reduce airscrew diameters. This condition cannot continue indefinitely. There is a critical aircraft velocity beyond which power and speed no longer balance. This speed is stated to be around 400 m.p.h., beyond which the diameter must increase with both power and speed. *Aeronautics*, September, 1940, pages 64–66, 69–70, 6 illus.

Rolling Airscrew Blanks. It has been found that surface rolling increases the fatigue-resistance of magnesium and aluminum alloys used for propellers. Forging roll made by Eumuco, Ltd., introduces a rolling process. Description of its operation. *Aircraft Production*, September, 1940, pages 275, 276, 3 illus., 1 diagram.

Radio

Plane Radio Beacon, Like a Lighthouse, Has a Rotating Beam. Mention of the new ultra-high-frequency rotating-beam radio beacon. *Popular Science*, October, 1940, page 98, 1 illus.

On Getting Along with F.C.C. R. H. Wilde. Use of a radio transmitter in a plane necessitates a license from the Federal Communications Commission, materially increasing the red tape that surrounds the private flyer. Recommendations are made for improvements in inspection, testing and other procedures. Private pilots are urged to join in drafting concrete proposals for F.C.C. consideration. *Sportsman Pilot*, September 15, 1940, pages 21, 28, 29.

Radio for Your Lightplane. Moulton Taylor. Traffic conditions at busy airports make a radio receiver almost a necessity for the private plane, and a transmitter desirable. Inexpensive aircraft radio equipment is described from the standpoint of the private flyer. *Flying and Popular Aviation*, October, 1940, pages 26–28, 89, 7 illus.

50-Watt Ground Station. Details of new dial-tuned 50-watt phone transmitter for ground use. Keyed cw. signals may also be transmitted, modulated or unmodulated. *Aviation*, October, 1940, page 62, 1 illus.

Radio "Lighthouse" Spins Signal to Guide Pilot on Course. Note on the new ultra-high frequency rotating-beam radio beacon. *Popular Mechanics*, November, 1940, page 731, 1 illus.

Radio Controls Seaplane Landing Buoys. The floating lights marking seaplane landing areas are turned on and off by radio. *Popular Science*, October, 1940, page 89, 1 illus.

C.A.B. Radio Program for 1941. Henry W. Roberts. More than 60 per cent of the C.A.B.'s appropriation of $11,297,047 for operation and maintenance of airways for the 1941 fiscal year will be spent on radio facilities; by the end of that year there should be 31,720 miles of airways, of which 30,223 will be fully equipped with navigation facilities. Details are given of this ambitious program, and there are also notes on the 1940 airways construction program, which was completed on schedule. *Aero Digest*, October, 1940, pages 71–72, 205, 2 illus., 1 chart.

Aviation Radio Instruction. Tenente Aviador Jose da Silva Correia. Methods and facilities of the Portuguese air force for giving radio instruction. *Revista do Ar* (Portugal), July, 1940, page 13.

Flight Instruction from the Ground. John R. Hoyt. Recommendations for the use of radio to transmit instruction from the ground to the student during solo flights, with brief description of the transmitter and how to obtain license for it. *Flying and Popular Aviation*, October, 1940, pages 38, 39, 68, 3 illus.

Rotary-Wing Aircraft

Sikorsky's Helicopter. Alexander Klemin. Short description of the VS.300 helicopter recently built by Vought-Sikorsky. *Scientific American*, October, 1940, page 189, 1 illus.

Helicopter Flown Successfully. Brief report of successful flight of Sikorsky's helicopter. *Popular Science*, September, 1940, page 50, 2 illus.

Testing Apparatus

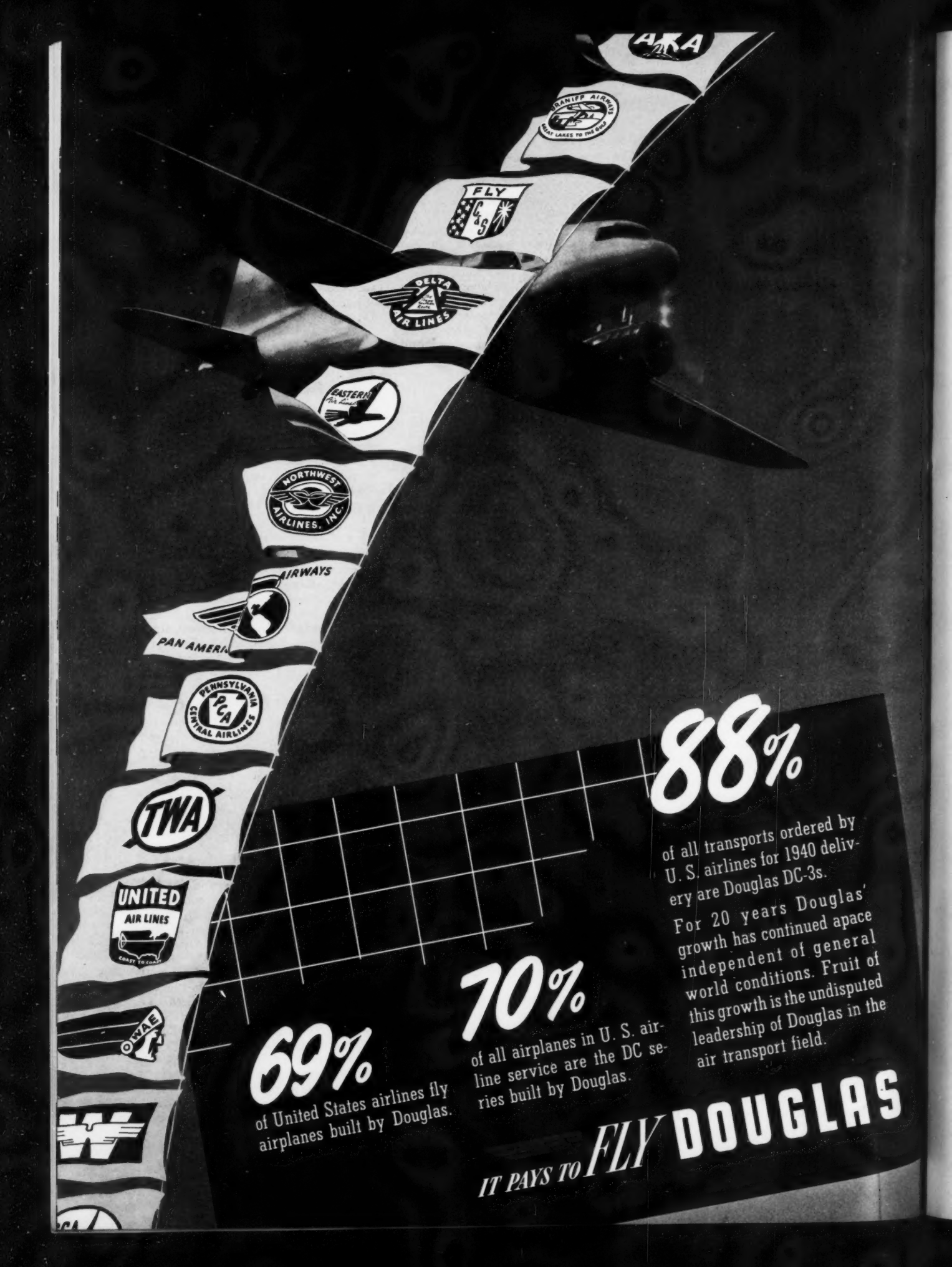
Drop Test of Shock Absorber. W. C. Trautman. Description of new high-speed photographic recorder developed by Bendix for use in testing aircraft shock absorbers. *Aviation*, October, 1940, pages 55, 94, 1 illus., 1 chart.

Wind Tunnels

Northrop Wind Tunnel. Eldon Wilson. The Northrop Aircraft Company has placed in operation one of the largest private wind tunnels in America. Details of its design, construction, operation are given by its project engineer. *Aviation*, October, 1940, pages 46–47, 3 illus.

Design for Research. C. L. Johnson. Details of the new wind tunnel being constructed by the Lockheed Aircraft Corp. *Western Flying*, September, 1940, pages 16, 17, 2 illus.

Plaster of Paris Shows Air Flow in Wind-Tunnel Tests. The use of plaster of paris powder to make air currents visible in a wind tunnel used for testing small models of airplanes. *Popular Mechanics*, October, 1940, page 485, 1 illus.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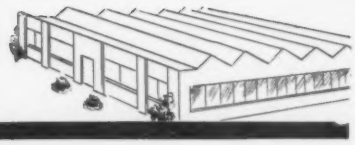

Aircraft Instruments

Pioneer Instruments, well known to the aviation industry, are to be found on many planes, where they are used to indicate temperature, airspeed, pressure, fuel flow, wheel position, rate of climb, acceleration, engine speed, direction, etc.

The catalogue gives comprehensive information as to construction, use, and installation, with dimensional drawings. Performance data are included where they will be helpful. *Pioneer Aircraft Instruments*, Pioneer Instrument Co.

Anti-Icing Pumps

Adel equipment includes anti-icing pumps, clips, and blocks for lines, Adelite synthetic rubber, and hydraulic distributor valve. Each unit thoroughly illustrated and described, with specifications, and many dimensional drawings. Complete material on Adel pumps with numerous performance curves is also given. *Adel Aircraft Equipment*, Adel Precision Products Co.

Fasteners

Classified catalogue of Parker-Kalon fasteners including many different types of self-tapping screws and studs. Parker-Kalon Corporation.

British Hydraulic Equipment

Dowty assemblies include retractable landing wheels, shock absorbers, pumps, and other hydraulic units. The catalogue states that over 80 per cent of all airplanes produced in England use Dowty shock absorbers.

Parts and units are thoroughly illustrated and described but few load or performance specifications are given. *Dowty Aircraft Components*, Aircraft Components, Ltd., England.

Electric Temperature Units

These instruments include thermocouples, selector switches and resistance thermometers, for airplane use.

The catalogue provides technical details, and has been produced by assembling in a single binder a number of bulletins describing the various instruments. *Lewis Electrical Temperature Measuring Instruments.*

Aircraft Engine Instruments

Catalogue illustrates and describes the company's line of temperature, pressure and suction indicators. Temperature and pressure indicators, both in single units and in combination, are available for engine temperature, oil pressure, fuel pressure, carbureter air temperature, outside air temperature, and landing gear air pressure, in addition to an ice-warning indicator.

The dial of each instrument is illustrated, and dimensional drawings are provided to aid the designer. *Manning, Maxwell & Moore Aircraft Instruments.*

Get Your Engineers Young

United Air Lines now sends selected college engineering students to maintenance bases to work as mechanics at regular wages, during their summer vacations. However, their work is supervised and a complete performance record is kept on each of them by their departmental foreman, toward the day when as graduate engineers they become members of United Air Lines Engineering Staff. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Twenty Years of Air Transport

Story of the 20th anniversary of the first transcontinental air route. United completed its 47,844th flight on September 8th. *United Airlines News*, September.

Meteorological Equipment

Taylor instruments illustrated and described in this catalogue include barometers, thermometers, anemometers, hygrographs, compasses, and many others available for the home, laboratory, and airport. *Short & Mason Scientific Instruments*, Taylor Instrument Companies.

Vought-Sikorsky VS-300 Helicopter

Helicopter in New Flight Tests. Equipped with a 90-hp. Franklin engine, Sikorsky's new helicopter makes flight tests. One flight of 15 minutes established a new record for direct lift aircraft in the United States. United Aircraft Corporation *Bee Hive*, August.

Permissible Speed of Propellers

Propeller Performance. Notes on the permissible speed at which fixed-pitch propellers may turn on planes equipped with engines of 100 hp. or less. Examples are given to illustrate the application of C.A.A. requirements. *Lycoming Star*, September.

TWA Training Program

TWA Pilots to Learn Celestial Navigation. Pilots on the major airlines (with the exception of Pan American's over-water navigators) are not required to learn celestial navigation. However, TWA feels that with the increasing demands of long range flying, celestial navigation will be used more and more to help pilots fix their position and if necessary to fly completely off the beam and charted airway to avoid bad weather. *The TWA Skyliner*, September 15th.

Short Cut to Rio

Nine hundred miles have been cut from the air route to Rio de Janeiro and more distant capitals of South American republics by a new airway directly across Brazil. Avoiding the coastal bulge, new overweather 4 motored Boeings will reduce previous fastest schedules by two days. Pan American Airways *New Horizons*, October.

Aviation Training

Aviation Activities Soar to New Heights. One hundred and fifty students now receive training in commercial and military training planes at the Ryan School of Aeronautics. In addition, numbers of mechanics and engineers are preparing themselves for careers in the industry. *Ryan Sky News*, Fall Issue.

Pan American to New Zealand

Pan American's new 8008 mile trans-Pacific air service from San Francisco and Los Angeles to Auckland, New Zealand, inaugurated September 11, forms an important new link in America's rapidly growing air transport system. Pan American Airways *New Horizons*, October.

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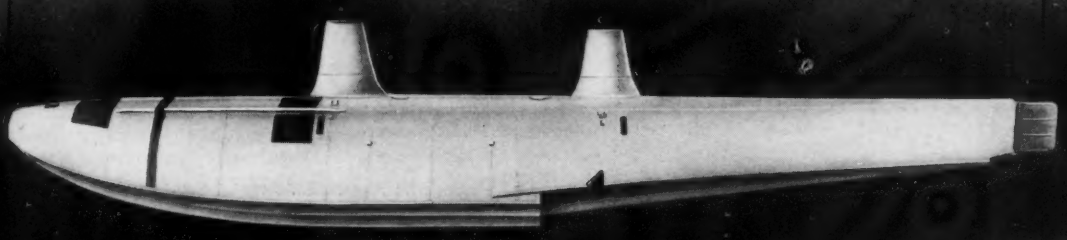

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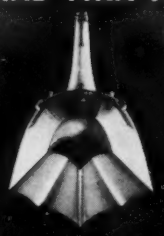

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AND FOREIGN AIR FORCES

52 Piper Cubs—Free

One Continental 65 hp. Cub Trainer each week is being offered in a radio contest by Brown & Williamson Tobacco Company, makers of Raleigh & Wings cigarettes. Details of the contest can be heard over N.B.C. networks each Friday at 9:30 p.m., E.S.T. *The Cub Flier*, September.

Court Case

Pan American files petition in U.S. Circuit Court of Appeals against decision of C.A.A. granting American Export Airlines, Inc., the right to operate a service paralleling Pan American Airway's transatlantic route. Pan American Airways *New Horizons*, October.

Record Breaker

An account of Jacqueline Cochran's recent international 2000 km. speed record, in a special version of the U.S. Army's P-35. *Republic Aviation Review*, August.

C.A.A. Shell Contest Finals

Prelude to Air Progress. Robert Greenlees. Successful contestants of C.A.A's. Civilian Pilot Training Program met in Washington, D.C., in September, to compete against one another in the finals of a nation-wide contest sponsored by the Shell Oil Company. Highlights of the Washington finals are given, together with names of the winners, the awards, and notes on some of the well-known men in aviation who attended. Shell Aviation Company *Shell Progress*, September.

Hydraulics at Consolidated

Outline of hydraulic control systems as now used on Consolidated aircraft with a schematic diagram of a system which operates the nose wheel. *Consolidator*, September.

Airline Pilot Ages

The Medical Director of United Airlines writes on health conservation. He gives the average age of the pilots of the airline. The captains averaged 35 years, the youngest being 27 and the oldest 49. The average age of First Officers was 27.7 years. *United Air Lines News*, September.

Pan American Travel Fellowships

Eleven Latin-American students have been granted Pan American Travel Fellowships for 1940–41. Begun in 1937 in cooperation with the State Department they are designed to enable a selected number of advanced students of Latin-American countries to travel by air to schools in the United States. Pan American Airways *New Horizons*, October.

For the Engine Designer

Information regarding sodium cooled valves and hydraulic valve lifters for aircraft engines. Wilcox-Rich Div., Eaton Manufacturing Co. *Hard Facts*, September.

More Republic Planes for Sweden

Details of Republic's new models for Sweden. *Republic Aviation Review*, August.

Douglas Employee Training Program

Training for Defense. The Douglas Aircraft's Personnel Department is cooperating with the Long Beach school system in giving special trade extension courses at the John Dewey School maintained by the Long Beach Board of Education to men whose previous training and experience can be adapted to aircraft work. Douglas loans the school whatever it can spare in the way of machinery, tools, and spare parts, and 2000 Douglas employees are expected to enroll in the many new trade extension courses offered. *Douglas Airview*, September.

The Instrument Mechanic

From Sperry's instrument mechanic training school will come the nucleous of trained instructors and mechanics to acquaint the Army and Navy in the use and maintenance of Sperry equipment. *Sperryscope*, October.

Aluminum Fabrication

The use of aluminum in aircraft manufacture is described and the effects on its properties when heat treated or when fabricated are given from the results of practical experience. *Republic Aviation News*, September 6th.

Non Stop

Preparatory flights for projected non-stop transatlantic air service to Europe by Pan American were completed in September. Pan American Airways *New Horizons*, October.

Light Plane Altitude Record

Betsy Ross reaches altitude of 18,200 ft. *The Lycoming Star*, October.

World's Largest Airplane

2,000,000 Man-Hours Work Produces World's Largest Airplane. Five years of research, three and one-half years of engineering, and two years of construction have gone into the Douglas B-19. With a standard railroad tank car gas capacity (11,000 gallons) and engines which develop 8000 hp., this 164,000-lb. airplane will have a cruising range of 7500 miles. Here is the story of its construction amply illustrated with many excellent photos. *Douglas Airview*, September.

Clearing Up the Record

A statement giving the facts about the much-publicized accidents to Beechcrafts, which newspaper readers were told were "due to structural failures in flight." The accidents occurred in bad weather to pilots who were not trained in or rated for instrument-flying but nevertheless were unwisely flying blind.

Subsequent tests by the C.A.A. showed that the leading edges would stand a load of 325 per cent above the theoretical applied load before failure under diving loading conditions, and 340 per cent above before failure in the pull-up condition of loading, whereas the C.A.A. required margin is 50 per cent for each condition. *Beechcraft Bulletin*, September–October.

3,000,000 Mile Pilot

First 3,000,000 Mile Pilot. United's veteran, E. Hamilton Lee, is the first pilot to total 3,000,000 miles flown. Beginning his flying career in 1913, he has since logged 21,500 hours. *United Air Lines News*, September.

Douglas Expansion Set for National Defense

At least 15,000 additional employees are to be given jobs by the time the Douglas program is under full sway. This will give Douglas about 33,000 men and women working on national defense and an annual payroll of $55,000,000, or more than $1,000,000 a week in Santa Monica, El Segundo, and Long Beach, exclusive of additional thousands employed by sub-contractors and suppliers working on Douglas business in other parts of the country. *Douglas Airview*, September.

50,000 Planes a Year

The aircraft industry, faced with proposed expansion to a capacity of 50,000 airplanes, is asked to increase production and production facilities by 400 per cent. A suggested policy for orderly expansion by T. P. Wright, Vice-President of Engineering of the Curtiss-Wright Corporation, discusses methods, costs, operation and objectives. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Manpower Shortage

A company college organized by Thompson Products, Inc., of Cleveland, offers a four-year course in machine tools, shop methods, factory engineering and management in the airplane and automotive parts industry and has awarded diplomas to its first graduating class. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Is there a ceiling to engine progress?

ONE MIGHT just as well expect the world to stand still as to expect the forward march of engines and their fuels to cease.

For as long as there are airplanes, men will want to fly farther and faster. As long as we have automobiles, the public will always hope for a car that offers still better performance, that gives more miles per gallon, that is even easier to drive than the splendid machines of today.

And so, too, buses, trucks, tractors — everything that depends on an engine for its power — will always be a challenge to the forward-looking engineer.

In this progress the Ethyl Gasoline Corporation, through its laboratories in Detroit and San Bernardino, plays a unique part. Though we are not directly engaged in the manufacture of fuels, engines or engine parts, we belong to both the oil and automotive industries. Thus we are able to cooperate with both industries; to help them unite their individual efforts toward the common goal of making transportation better and cheaper.

We realize that no one man, organization or industry can go far or fast alone. Because engines and their fuels are so closely related, they must progress together.

The development of new metals, new ceramics, new gasolines, and their adaptation to future engine designs, incorporating such advances as super-charging and super-compression, require the combined efforts of many research men in many industries. It is to these men, who believe that the progress of the next ten years will far exceed that of the past ten, that our research and service facilities, data and equipment are available.

* * *

Ethyl Gasoline Corporation, Chrysler Building, New York City, manufacturer of anti-knock fluids used by oil companies to improve gasoline.

Better and more economical transportation through

ETHYL RESEARCH

The Technical Information Service
of the
Institute of the Aeronautical Sciences

This service has experienced personnel under the supervision of trained aeronautical engineers to compile any information desired. The services range from listing specialized reference books to the preparation of exhaustive bibliographies, digesting of reports and general surveys of any aeronautical subject.

Some of the available services are:

Bibliographies on any aeronautical subject.

Reports on any aeronautical subject.

Digests of aeronautical books, papers, periodicals and references.

Translations in all languages.

Engineering investigations of special aeronautical subjects.

Biographies of individuals engaged in aeronautics.

Photostats of any aeronautical or general engineering material.

Microfilms made on special order.

Photographs made from the Institute's photographic collection.

Drawings and tracings made.

In addition to the services mentioned any commission which comes within the scope of the Service will be accepted.

Research work is charged at the usual library fee of $2.00 per hour. Special arrangements may be made for work requiring several weeks or months.

Translators are available for accurate transcriptions of all foreign language data. Translations are carefully edited by trained engineers at the standard rate of 1¢ per word. Minimum charge, $2.00.

Reproductions of any material in the Aeronautical Archives of the Institute may be ordered at standard photostat rates.

Gust Acceleration Loads

The Greek Word Was Kinetikos. A study of kinetic energy at high speeds, and the effect of greater speeds on gust acceleration loads. Gust acceleration loads caused by bumpy air increase with the speed, and the design safety factor decreases with increasing kinetic energy. The study shows that high speeds in bumpy air can cause a normally ample margin of safety to shrink to zero with a relatively small increase in speed. *Beechcraft Bulletin*, October.

Ready to Build Airpower

In 1938 Lawrence D. Bell, President of Bell Aircraft Corporation, made a personal survey of the German aviation industry and found it to be turning out Messerschmitt 109 fighters at the rate of 10,000 a year. He returned convinced that the United States has the resources to surpass foreign production in both quality and quantity. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Aircraft Hydraulics

A comparison of hydraulic and electrical control systems in which elementary principles of hydraulic systems and control are explained. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Rickenbacker Trophies

Picture and description of the presentation of the Rickenbacker trophies to members of the Eastern Airline's Flying Fisherman Club at a dinner in Chicago. Eastern Airlines *Great Silver Fleet News*, Autumn edition.

Racer to Trainer

When Colonel Roscoe Turner climbed from the cockpit of his racing airplane a three time winner of the Thompson Trophy Race last September, he said that he was through with racing for good. He then disclosed his intention of opening his own flight school. Located at Indianapolis, his school now trains private, commercial, and also advanced students and instructors for the Civilian Pilot Program. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Plane Builder at 16

When Henry Tofflemire Built an Airplane! Back in 1917 Eastern Airlines pilot Henry Tofflemire, then a lad of sixteen, built an airplane. Home-designed, home-made, and home-flown, each hedge hopping flight cost him so much in repair time and money that he finally sought other and more practical means of building up flying hours as a pilot. Eastern Airlines *Great Silver Fleet News*, Autumn Edition.

Stainless Steel for Airplanes

Stainless Steel Produces Lighter, Sturdier Aircraft. It is stated that stainless steel, with three times the strength of low-carbon steel, can equal the weight–load ratio of light metal alloys in modern airplane construction through proper design. Moreover the fact that stainless steel can be spot welded gives it an advantage of speed in processes of fabrication. Electro Metallurgical Company *Electromet Review*, October.

Success Story

The Path of the Eagle. Fine record of the Pennsylvania-Central Airlines is due in large measure to the cooperative spirit and high morale of its employees, and the leadership of executives who are experienced fliers. *Douglas Airview*, September.

Aerial Cameras

Career outline of Sherman M. Fairchild, showing some of the many aerial cameras which bear his name. Since the completion of his first aerial camera at the close of the World War, he has developed special equipment such as camera machine guns, 10-lens aerial mapping cameras, high altitude military reconnaisance cameras, and special cameras for night photography. Allegheny Ludlum Steel Corporation *Steel Horizons*, Special Aviation Issue.

Four fly in comfort at two cents a mile in a FAIRCHILD

ONE naturally expects luxury of detail and design from Fairchild. But Fairchild owners enjoy these qualities at an operating cost whose spectacular economy often comes as astonishing news to the owners of other ships with comparable payloads.

In a Fairchild you get pampering comfort for four persons—with ample head-room, leg-room, and arm-room—easy access through two wide doors—gas capacity for six hours' cruising—*at a fuel cost of two cents a mile!*

You get dependability and ruggedness of structure as evidenced by recent CAA purchases of 33 Fairchilds for government use—uncompromising standards of engineering to assure long life, low maintenance, and minimum depreciation—*and the fuel cost is only two cents a mile!*

You get easy landings, quick take-offs, effortless flying, hydraulic brakes, steerable tail-wheel—*and yet the fuel cost is only two cents a mile!*

It takes less than a minute with a pencil—and less than an hour with the stick—to convince yourself that Fairchild is aviation's best bargain in luxury and quality—by the cost per mile—or the cost per year!

FAIRCHILD AIRCRAFT

Division of Fairchild Engine & Airplane Corporation
Hagerstown, Maryland . . . Cable Address "Faircraft"

From the Industry

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Review.

Aeronautical Chamber of Commerce of America

With a view to establishing a more equitable determining date for amortization, the Aeronautical Chamber of Commerce of America, Inc., laid before the Senate Finance Committee the results of a survey showing that the aviation industry completed plant expansions and installations of new equipment costing a total of $52,445,255 between September 8, 1939, the date the national emergency was declared to exist, and July 10, 1940, the date used by the House Ways and Means Committee for the beginning of amortization under the proposed new excess profits tax legislation.

The purpose of the survey was to acquaint the Senate Finance Committee with the hardships which would result from the use of the July 10, 1940, date for beginning amortization deductions. The Chamber pointed out that unless the earlier amortization date is used, the manufacturers will have on their hands a large investment in idle plants and facilities which will not be needed under normal conditions and which must be carried as costs in future curtailed production.

Of the $52,445,255 spent between September 8, 1939, and July 10, 1940, in completion of new facilities, Colonel John H. Jouett, president of the Aeronautical Chamber of Commerce, said the survey indicated that only $11,388,917 worth of these facilities will be required by the industry at the close of the emergency, leaving an excess of $41,056,336 in new equipment. He emphasized that it is this excess of $41,056,336 which will not be subject to amortization unless the September 8, 1939, date is substituted in the final tax law.

The survey of the industry showed that of the total, $34,732,113 was spent in new facilities for expanded production of airplane engines and propellers between the dates mentioned; that $13,089,655 was spent on new airplane production facilities, and that $4,623,487 was expended for new facilities for aircraft accessories and instruments. Colonel Jouett emphasized that contrary to popular belief all of this added investment was by no means provided in contracts on foreign orders. The costs of plant expansion for airplane, instrument and accessories production was financed approximately 100 per cent by the manufacturers themselves, while the new investment for engine and propeller production was financed 65 per cent by the companies, he said.

The industry's spokesman also informed the Senate Committee that many aircraft companies completed plant expansions for the purpose of meeting anticipated aircraft requirements of our own Government and therefore should be given credit for their initiative in making these investments before actual orders were placed.

Commenting on the Excess Profits Tax Bill signed by the President, aircraft manufacturers speaking through the Aeronautical Chamber of Commerce of America, said:

"More speed toward arming America in the air and a businesslike procedure in handling the enormous job are assured by amortization provisions of the Excess Profits Tax Bill, signed today by President Roosevelt.

"From the beginning of the present emergency the nation's aircraft manufacturers have been expanding their production facilities to the limit of their financial ability. The aircraft industry readily assumed investments and commitments of more than $150,000,000 to carry out the Government's program. These important steps, undertaken by the industry at its own risk and initiative, and carried out in the face of legal uncertainties and handicaps, have saved months of valuable time.

"The aircraft industry takes this occasion to reiterate its pledge of voluntary and wholehearted cooperation in our common task of national defense. We will continue to hold production for defense paramount to all other considerations."

Department of Commerce Civil Aeronautics Administration

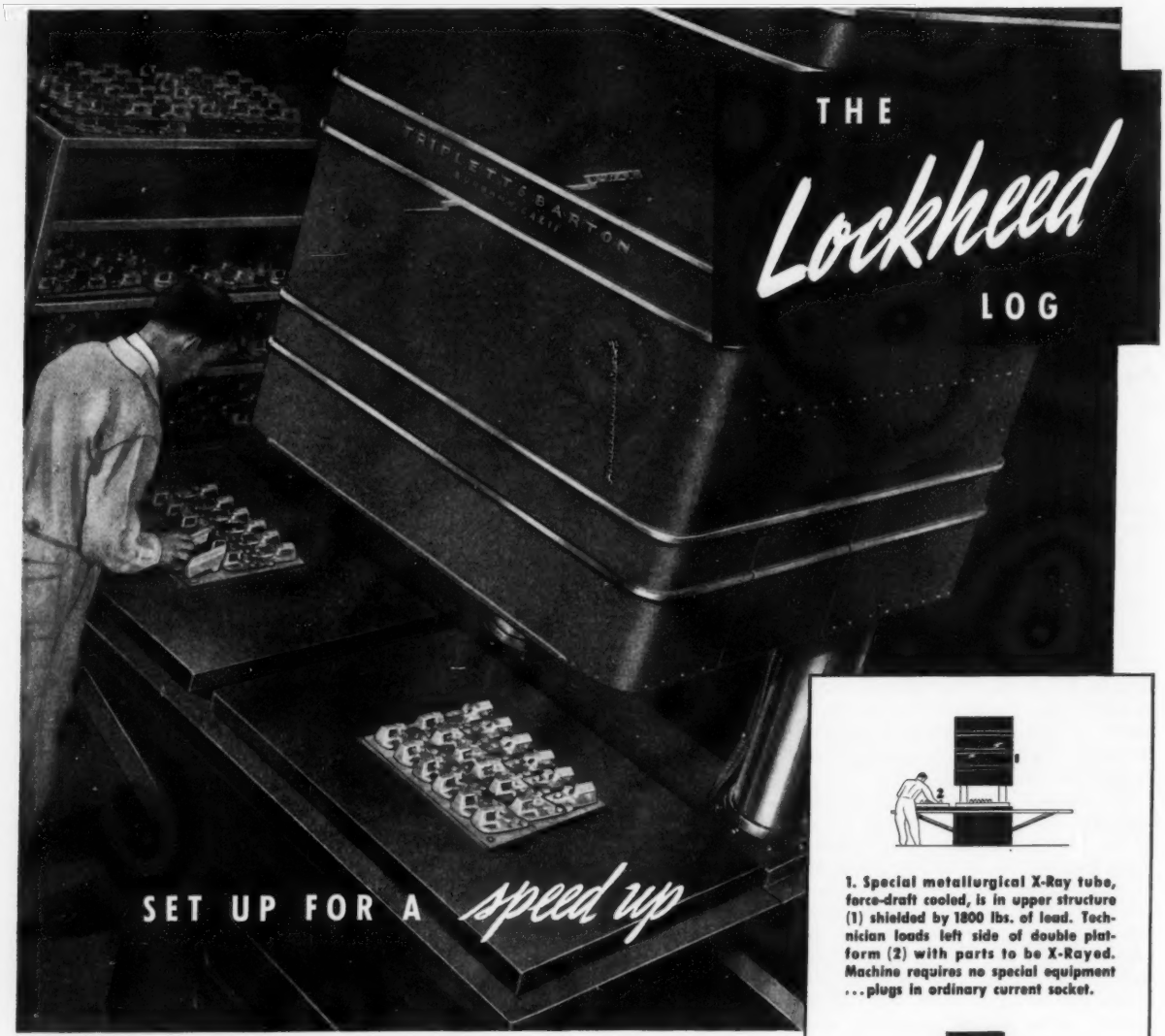
In the interest of safety to student fliers, airline passengers, and the expanding military air force, the Civil Aeronautics Administration has restricted Civilian Pilot Training instruction flying from 46 of the nation's busiest airports, Colonel Donald H. Connolly, Administrator of Civil Aeronautics, said Sunday.

Civilian Pilot Training flight units now located at these fields do not have to pick up "bag and baggage" and move elsewhere, Colonel Connolly explained. They still can base there as before. But their flight operations at these sites must be limited to flying their training aircraft from hangars to outlying fields and back to the hangars. All flight instruction must be carried on at outlying fields at least six miles from the airport named, he explained.

"Necessity for this action has been growing steadily since June," Colonel Connolly said. "Airline business has been increasing very rapidly. At the same time, military aircraft have been based, or will be based, on many civil airports, and also have been doing much more point-to-point flying.

"When you add to these factors, which will increase in intensity, the large expansion of the Civilian Pilot Training Program itself, action becomes urgent."

The Administrator said 17 of the airports were placed on the restricted list because of "heavy scheduled air carrier operation, operations by military aircraft engaged in point-to-point flying and the tremendous load of transit aircraft."



Lockheed X-Rays more parts than all other aviation manufacturers combined

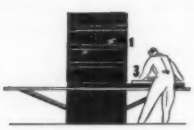
They designate this machine only as "40-1"* at Lockheed. Yet it's a new, completely automatic X-Ray unit, the only one of its kind in the world. It's 20 times as fast and twice as accurate as any other comparable X-Ray equipment. Ten such units could photograph and assure the perfection of all the stress parts necessary for aviation's part in the National Defense Program.

* Patents Applied For

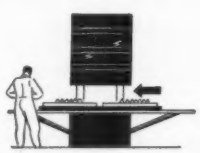
This safety vigilance *actually speeds up production* because it rejects any imperfect parts before they reach the production line, and assists in putting Lockheed in an advance position to meet present demands on the aviation industry.

Pioneered by Lockheed, and *constantly* expanded by Lockheed, this kind of engineering provides further assurance that you may safely...

1. Special metallurgical X-Ray tube, force-draft cooled, is in upper structure (1) shielded by 1800 lbs. of lead. Technician loads left side of double platform (2) with parts to be X-Rayed. Machine requires no special equipment ...plugs in ordinary current socket.



2. Loaded side has automatically moved under X-Ray tube. Shield lowers, and while exposure is made technician reloads opposite platform (3). This type of "production-line" testing enables Lockheed to accelerate manufacture with no sacrifice of safety vigilance.



3. Re-loaded side is moving into position for picture. Note that every operation of machine is automatic. The only equipment of its kind in the world. Designed, built and operated at Lockheed by Triplett & Barton Laboratories, Inc.

LOOK TO *Lockheed* FOR LEADERSHIP

LOCKHEED AIRCRAFT CORPORATION • BURBANK, CALIF., U.S.A.

Consolidated Aircraft Corporation

All physical assets, as well as the name and good will of the Hall-Aluminum Aircraft Corporation of Bristol, Penna., have been merged through purchase with Consolidated Aircraft Corporation. Thus tersely may be stated the fact that Hall-Aluminum Corporation is now a part of Consolidated Aircraft Corporation.

Hall-Aluminum Aircraft Corporation had its beginning in Charles Ward Hall, Inc., in 1916. Since that time and until the formation of Hall-Aluminum Aircraft Corporation, Inc., in 1927, Charles Ward Hall, President and sole stockholder had been continuously engaged in research in the use of aluminum alloys in connection with the design and construction of aircraft. Mr. Hall applied for and was granted numerous basic patents relating to this field.

In 1927 Hall-Aluminum Aircraft Corporation was incorporated through the purchase from the late Charles Ward Hall of all assets belonging to Charles Ward Hall, Inc. The new company until its acquisition by Consolidated Aircraft Corporation has been engaged in the design and manufacture of aircraft, particularly flying boats and seaplanes, aircraft parts and sections, and in overhaul and repair work.

Throughout this period and to the present time the corporation produced and supplied parts and standardized aircraft sections to all principal manufacturers and producers in the United States and Canada. Besides supplying the U.S. Navy with many of its aircraft the company has also supplied the Coast Guard with numerous craft.

Douglas Aircraft Company

Trailblazer for American engineering and craftsmanship in building the nation's air defense is the giant Douglas B-19, according to officials of Douglas Aircraft Company, who made new disclosures on the Army's superbomber. (See front cover.)

Nearing completion at the Douglas plant here, the B-19 boasts performance and structural features which place it in the forefront of military aeronautics. Largest and most powerful airplane ever constructed, the craft is a veritable aerial dreadnaught, armed with machine guns, cannon and huge bomb load.

Concentrating on range and striking power rather than speed, the B-19 is up to the minute in every respect. Including a tricycle landing gear and retractable nose wheel, it is of all-metal construction along proven Douglas lines.

Its wings spreading 212 feet from tip to tip, the sky leviathan will weigh fully loaded more than 80 tons, and will have four air-cooled Wright-Duplex-Cyclone engines, each generating 2000 horsepower. Top speed exceeds 200 m.p.h.

With an amazing range, under some conditions, of more than 7500 miles, the B-19 will transport a normal crew of ten men and 18 tons of bombs. Its fuel storage equals the capacity of a railway tank car. If equipped as a troop transport the airplane could carry 125 fully armed men.

In a few weeks the ship is expected to be wheeled out on Clover Field, Santa Monica's Municipal Airport, to begin a series of ground checks preliminary to the test flight later this fall.

When the airplane is eventually taken over by the United States Army Air Corps, it will become a flying laboratory for assembling structural and tactical information, and serve as a guide in the design and construction of the great cargo and troop transports of tomorrow.

Although largest and most spectacular in size and armament, the B-19 is but a small portion of the aircraft industry's contribution to national defense. In size, speed and performance, American-designed and built airplanes lead the world and soon will provide this country's armed forces with distinct aerial supremacy.

Design Requirements: 9000 drawings required, which would cover an area of 4 acres; 500 engineers, technicians, and mechanics employed on craft; 700,000 hours engineering time; 42,500 hours research and testing time; 1,250,000 hours shop time; 4 years from start of design to first flight.

Construction Details: 212 ft. wing spread; 132 ft. fuselage length; 42 ft. 9 in. overall height to top of rudder; 61 ft. span of horizontal stabilizer; 100 in. diameter of main landing gear wheels (54 in. diam. of nose wheel); 2 miles of control cable; 10 miles of electrical wiring (enclosed in conduits) 3,000,000 rivets; 4 Wright-Duplex-Cyclone engines each generating 2000 hp.; 83,253 lbs., weight empty; 140,000 lbs., normal gross weight; 164,000 lbs., alternate gross weight.

Performance: 210 m.p.h. maximum speed; 186 m.p.h. operating speed; 69 m.p.h. landing speed; 7500 miles range; 22,000 ft. service ceiling; 11,000 gallons fuel capacity; 10 men normal flight crew (sleeping accommodations for 8); 18 tons bomb capacity; 28 tons total load capacity.

The Glenn L. Martin Company

Lighter yet stronger materials—that is the never-ending search of the aircraft industry. And now The Glenn L. Martin Company, of Baltimore, comes forward with a new wrinkle, a bomb-bay door so light that two frail girls can hold it with one hand each, yet so strong that nine people seated on it do not even bend it. And what is this prodigious new material? It is (of all things) wood—but a special kind of plywood and strong, light plastic material, cleverly designed for the famous Martin bombers. Fourteen feet long, it weighs but 41 lbs. and is stressed to bear more than 3000 lbs. of weight. Reid B. Gray, chief of the Martin laboratories, Robert L. Hildebrandt and George W. DeBell developed the door. The bomb-bay doors are part of the under-side contour of the airplane and are thrown open by the bombardier just before he is ready to release the lethal "eggs" over the objective.

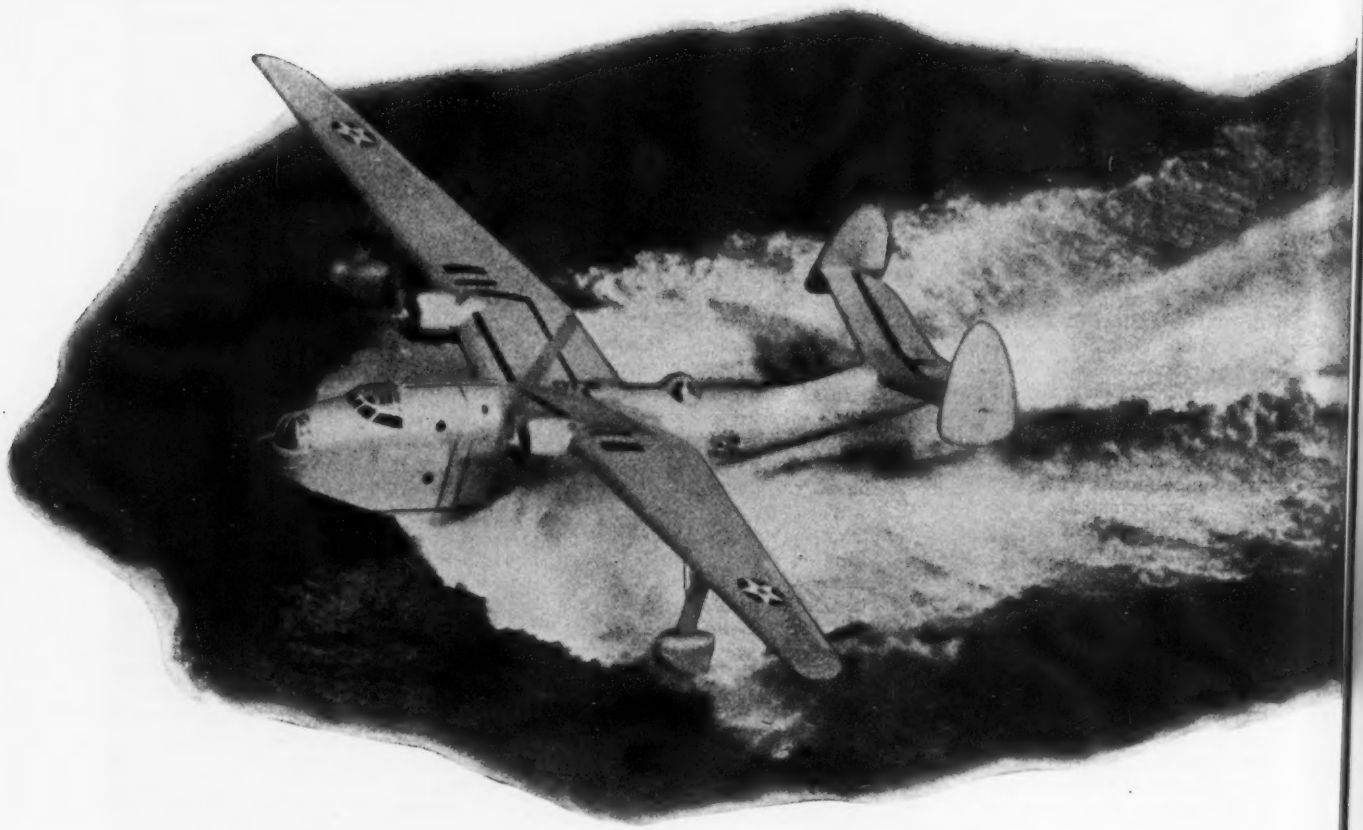
Lockheed Aircraft Corporation

Following recent statements on the manner in which the aviation industry is fulfilling its part of the defense program, Robert E. Gross, president of the Lockheed Aircraft Corporation, continued a policy of full and frank discussion of many of the company's problems in a special communication addressed yesterday to the stockholders.

Mr. Gross said that stockholders and the public are entitled to know how management is attempting to cope with the confusing and complex problems that demand immediate solution.

"With aviation our first line of defense, everyone is vitally interested in the ability of managements to speed up production, the companies' resources, expansion plans, and the supply of labor," he said. Only last week Lockheed issued its semiannual report giving figures on its financial position, orders, deliveries, earnings, etc., but "since everyone is attempting to appraise today's uncertainties, stockholders are undoubtedly interested in many other matters," Gross said. These include the possibilities in the event of cessation of hostilities, the effect of profits limitation or the expected excess profits tax legislation, protection on foreign orders, possibility of competition. These and other questions are answered in this latest communication.

Over a period of years the possible reduction of foreign orders and their replacement with business under a protracted rearmament program in the United States might result in a smaller profit margin, but Mr. Gross emphasized that he did not believe that in the



A Battle Cruiser takes off . . .

BY LEE E. FRANK

To the Navy it was a relatively routine matter . . . a patrol plane setting off on a mission under orders.

But to me . . . it was an awe-inspiring sight . . . a powerful battle-cruiser breaking the traditional shackles of Neptune and invading a new medium of flotation in symbol of our country's sovereignty.

The giant flying boat turned . . . its motors thundered their challenge . . . the boat moved faster and faster! Gaining speed it lifted on the water . . . the whirl of foam behind it attained cyclonic proportions . . . on it sped! Suddenly the trail of white ceased . . . it was in the air!

Yes . . . in the air . . . a giant measured in many tons had left the water as smoothly and as effortlessly as if endowed by Nature with the ability to fly. It was a magnificent sight . . . and a reassuring one, too.

For within that hull were means to preserve the liberty, happiness and peace of our country and our people.

Now a speck in the sky above the horizon, the plane is on its mission . . . filling the gaps between our Naval sea forces in their defense of our far-flung neutral zones. An eagle eye of the Navy . . . with the Eagle's striking power against air and surface craft ready when the occasion demands.

In 16 hours it may be back . . . having covered in its course several thousand miles. Or it may not be back for a week or a month. It may settle in a tropical harbor . . . or under some rocky northern cliffs for the night . . . to be on its way again in the morning. It may contact some distant Naval unit . . . may operate with it for days or weeks. But regardless of its mission . . . it will accomplish it with dispatch and efficiency.

It is literally a battle-cruiser of the air . . . with complete accommodations for its crew . . . capable of operating over tremendous ranges . . . from shore or ship bases. A sailor interrupted me . . . "It's one of those new Martin PBM-1's . . . off on a run" . . . I thrilled to the occasion.

Published by

THE GLENN L. MARTIN COMPANY

BALTIMORE, MARYLAND, U. S. A.

Builders of Dependable *Aircraft Since 1909*

TRADE MARK

long run the company's earnings would be adversely affected. He pointed out that much of Lockheed's present expansion was to provide facilities for the U.S. defense program. This, irrespective of foreign orders, should provide the aviation companies with a constantly increasing volume of business that would more than compensate for any reduced profit margin, whether through limitations or subsequent tax legislation.

The normal growth of air travel and increase in demand for private planes has continued in this country in spite of the tremendous demand for military planes. Mr. Gross said he expected the development of this business in the post-war period to be phenomenal because of the tremendous number of men who will be trained to fly and because of the rapidly expanding facilities which will permit cheaper production.

United Aircraft Corporation

The Pratt & Whitney Aircraft Division of United Aircraft Corporation celebrated its fifteenth birthday in August and pointed with pride to the rapid growth it has undergone in the last decade and a half—a fact which is particularly significant now, when industry stands challenged before the problems of national defense.

Back in 1925, three men—F. B. Rentschler, D. L. Brown and George J. Mead—undertook to pioneer the design and construction of a 400-horsepower radial air-cooled aircraft engine for the Bureau of Aeronautics of the U.S. Navy. With a tiny nucleus of 25 persons, they began work in an idle building of the Pratt & Whitney machine tool factory at Hartford, Connecticut, a building which had been temporarily used as a tobacco warehouse. By Christmas of that year their engine, the first of the now-famous "Wasp" series, had been completed and held the distinction of being more powerful than any comparable American engine then in existence. It passed the Navy acceptance tests with flying colors and displayed such characteristics of endurance that the Navy immediately ordered six experimental engines. Another Navy order for 200 soon followed, and these early Wasps performed so well that they were largely responsible for the Navy's later decision to standardize on air-cooled engines for all its aircraft.

From that time on, the growth of Pratt & Whitney Aircraft was swift. A year after its humble beginnings there were 100 men on its payroll; in two years, 275 men; 600 in three years; and, at the five-year mark, when other aviation firms joined the group that now constitutes United Aircraft Corporation, 1300 workers were employed at the newly completed Pratt & Whitney Aircraft plant in East Hartford, Connecticut. This structure covered 400,000 square feet of floor space. Now the Pratt & Whitney plant covers more than a million and a quarter square feet in area and employs over 10,000 men and women daily in three regular shifts.

Continuing its pioneering, in 1929 Pratt & Whitney produced the first successful 14-cylinder, twin-row air-cooled engines in America, known as the Twin Wasp and the Twin Wasp Junior. These were rated at 1200 and 825 horsepower, respectively. Later, a still larger twin-row engine, the 1400 horsepower Twin Hornet was developed. And in 1939, another triumph was achieved in the successful completion of development of the new 18-cylinder twin-row engine known as the Double Wasp. At completion of its development period, this engine was rated at 1850 horsepower. This power has since been increased, and the engine is the most powerful and compact now in quantity production in the United States.

Pratt & Whitney Aircraft has continued to grow in leaps and bounds as its engines have found ever-widening uses in commercial and military fields. Sixteen thousand Pratt & Whitney engines left the test stands before the end of 1938 for service everywhere and were in use on airlines in 36 countries; on pioneering Pacific and Atlantic flights; on millions of miles of scheduled domestic air routes; on Navy aircraft carriers, battleship catapults, and at Army air bases.

Early in 1939, Pratt & Whitney Aircraft expanded to include a 100,000 square-foot factory adjacent to its own as additional production capacity needs were foreseen. When Allied demands supplemented those of our own country, a factory addition was erected which brought the production of Pratt & Whitney engines to a level of 850,000 horsepower a month. Construction of this factory was undertaken at such a pace that the first machines were in operation three months after the ground was broken in October, 1939.

Closely attuned to the national defense program, expansion efforts still continue. Only this July, work was begun on still another plant addition which is designed to increase Pratt & Whitney's monthly engine output to 1,200,000 horsepower. Such a production figure will far exceed the average yearly production which occurred during the period 1925–38. Likewise in tempo with the times is the speed at which this factory will be erected. Plans call for the beginning of production by the end of this year.

Several millions of dollars have been added to the plant account of Pratt & Whitney in less than two years, because of its rapid expansion program. Such rapid flexibility should prove a happy answer to our government's demands for increased production of aircraft engines. It should prove that industry is able and willing to do its part to supply the commercial and military air services of the United States with the finest aircraft equipment obtainable, whenever and wherever needed.

Civil Aeronautics Board of the Civil Aeronautics Authority

Representatives of the Civil Aeronautics Board have recently returned from Ottawa, Canada, after having discussed with representatives of the Canadian Department of Transport the inauguration of new international air services between the United States and Canada. The conference was for the purpose of giving effect to Article III of the Air Transport Arrangement entered into between the governments of the two countries on August 18, 1939, providing for the operation of scheduled air services across the border. Conferees will recommend to their respective governmental agencies a program for the division of routes and services between carriers of the two nations on a reciprocal basis.

The present unsettled conditions were recognized by those attending the conference. The effective period of the recommendations, should they be approved and given effect by the responsible agencies of the two governments in the several cases in which they would be involved, was limited to December 31, 1942, before which time a further conference should be held for the purpose of considering further developments and agreeing on future policies.

The American representatives at the conference were Edward Warner, Vice-Chairman, and George P. Baker, another Member of the Civil Aeronautics Board, and Samuel E. Gates, the Board's International Counsel. The Honorable J. Pierrepont Moffat, American Minister to Canada, attended the sessions of the conference as an observer.

The Canadian Government was represented by The Honorable C. D. Howe, Minister of Munitions and Supply, Colonel V. I. Smart, Deputy Minister of Transport, Commander C. P. Edwards, Chief of Air Services, J. A. Wilson, Controller of Civil Aviation, and P. T. Coolican, Deputy Assistant Postmaster General of Canada.

Millions for Defense

America needs airplanes, engines, and propellers—by the thousands. To build them, and build them fast, America must have larger and better equipped aircraft factories than ever before.

A year and a half ago, United Aircraft began a vast expansion program toward this end. Sixteen million dollars have been spent in 18 months to increase its manufacturing facilities. Today that program is virtually complete, and three modern plants are humming 24 hours a day, building Pratt and Whitney engines, Hamilton Standard propellers, and Vought-Sikorsky aircraft at the fastest rate in their history.

Now, in anticipation of increased National Defense requirements, United Aircraft is spending 15 million dollars *more* to increase further the production facilities of all three plants. This entire program has been worked out in close cooperation with the United States Government.

We are ready to do our part of the job—and we pledge the entire resources of United Aircraft to doing it speedily and doing it well.

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INDEX TO ADVERTISERS

The B. G. Corporation	18
Bendix Aviation Corporation	Back Cover
Boeing Aircraft Company	20
Consolidated Aircraft Corporation	22
Curtiss Aeroplane Division, Curtiss-Wright Corporation	24
Douglas Aircraft Company	26
Edo Aircraft Corporation	28
Ethyl Gasoline Corporation	30
Fairchild Aviation Corporation	32
Intercontinent Corporation	2
Kollsman Instrument Division, Square D Company	52
Lockheed Aircraft Corporation	34
The Glenn L. Martin Company	36
Oakite Products, Inc.	42
Shell Oil Company	Inside Front Cover
Simmonds Aerocessories, Inc.	42
Sperry Gyroscope Company	Inside Back Cover
United Aircraft Corporation	38
United States Aviation Underwriters	52
Wellington Sears Company	40

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Abbreviations Used

A.S.M.E.—American Society of Mechanical Engineers.
D.V.L.—Deutsche Versuchsanstalt für Luftfahrt.
N.A.C.A.—National Advisory Committee for Aeronautics.
R.Ae.S.—Royal Aeronautical Society.
S.A.E.—Society of Automotive Engineers.
V.D.I.—Verein Deutscher Ingenieure.
Z.F.M.—Zeitschrift für Flugtechnik und Motorluftschiffahrt.

The Executive and General Offices of the Institute. The office of the Executive Vice-President contains over 150 signed photographs of past and present leaders in the aeronautical sciences in the United States and abroad. Aeronautical murals, prints and engravings, models of airplanes and aeronautical trophies decorate the general offices.

Institute of the Aeronautical Sciences
1932–1940

The Organization of the Institute

THE PURPOSES OF THE organizers of the Institute was to found in the United States an aeronautical society which would give aeronautical engineers an independent engineering organization similar to those in other professions which have rendered such important services to the progress of engineering here and abroad. This country had several engineering societies which provided for the disclosure of certain industrial applications to aeronautics, but none that stressed the disclosure of those advances in the aeronautical and allied sciences which are in the field usually termed that of pure science.

The need was obvious, and on October 15, 1932, the Institute of the Aeronautical Sciences was incorporated by several aeronautical specialists under the membership corporation law of New York State. The purpose of the Institute as stated in the charter is as follows:

> "To advance the art and science of aeronautics; to publish works of literature, science and art for such purpose; to do all and every act necessary, suitable and proper for the accomplishment of any of the purposes or the attainment of any of the objects or for the furtherance of any of the powers hereinbefore set forth, either alone or in association with other corporations, firms or individuals and to do every other act, thing or things, incidental or appurtenant to or growing out of or connected with the aforesaid science or art, or powers or any part or parts thereof, provided the same be not inconsistent with the laws under which this corporation is organized or prohibited by the laws of the State of New York."

The founders of the Institute believed that the future development of aircraft depended on scientific research and engineering experiment applied to design, and by including in the scope of the Institute's activities the allied sciences of meteorology, radio, metallurgy, physics and chemistry a broad base was provided for aeronautical progress.

On October 17, 1932, a constitution was adopted which gave broad powers to the Council until such time as the members of the Institute wished to make changes. At the Founders Meeting held at Columbia University on January 26, 1933, the constitution and by-laws were approved by the membership and the first Council elected.

Eight Years of Progress

The organizers of the Institute proceeded slowly as they did not foresee the unanimous response that their program was to receive from such a large number of distinguished scientists, engineers, pilots and industrialists interested in aeronautics here and abroad. In eight years the Institute membership has increased from 400 to over 3000 in 1940. The Institute occupies a suite of offices in Rockefeller Center, New York, and is directed by an experienced staff.

Institute assets increased from $1100 in 1933 to over $100,000 in 1940. At general meetings and meetings of 38 Branches and Sections of the Institute knowledge of the latest developments in the aeronautical sciences and the aircraft industry is discussed. The Journal of the Aeronautical Sciences provides members and others with an opportunity to publish the results of their investigations in the field of aeronautics. It is sent to over 4500 specialists in aeronautics and allied fields.

A free lending library service has available the latest aeronautical books. The largest specialized aeronautical index in the world provides information for members of the Institute, aeronautical companies, newspaper writers, research engineers and others.

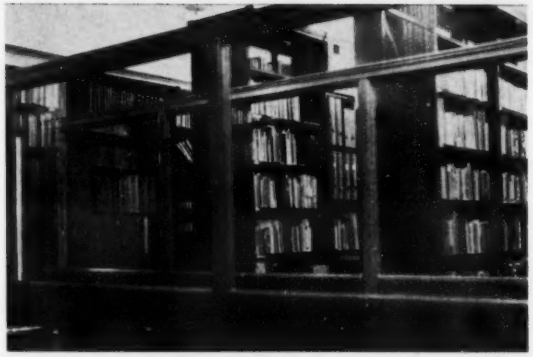
Through these and other services, the Institute is providing the United States with an aeronautical scientific society similar to those which have such a beneficial influence on scientific and engineering progress here and abroad. It is now recognized as one of the leading aeronautical scientific and engineering societies in the world.

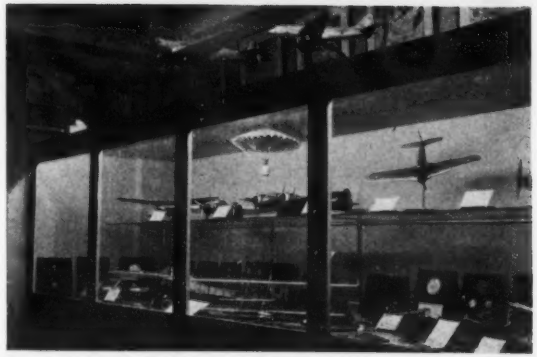
Meetings

National, Sectional and Branch meetings render a direct service to both Institute members and the aeronautical profession by disseminating the latest knowledge of progress in aeronautics.

Technical sessions in every field of aeronautics are held at the Annual Meeting of the Institute each January in New York. A Pacific Coast Annual Meeting is held in June of each year. The thirty-eight Branches and Sections of the Institute hold monthly meetings at which lectures are given and motion pictures, supplied by the Institute's aeronautical film library, are shown. In addition to these scheduled meetings, Branches and Sections invite prominent aeronautical specialists to present papers at technical sessions, and papers covering a wide range of

Aeronautical murals, prints and engravings, models of airplanes and aeronautical trophies decorate the general offices.





The Aeronautical Archives and Libraries of the Institute. These general views show sections of The Paul Kollsman Library, the Burden Library, the Aeronautical Indexes, and reading room. The walls of the reading room are hung with famous prints and engravings from the Harry F. Guggenheim collection. Models of historical airplanes, rare trophies, and medallions are on exhibit. Two special bookcases, one of which is shown above, contain a collection of rare books on aeronautics dating back to the year 1600.

aeronautical subjects are presented and discussed. About seven such technical meetings are held by Sections and Branches every year.

Honors and Awards

Through the generosity of benefactors and donors, the Institute is able to give many honors and awards.

The Sylvanus Albert Reed Award. This award was established in 1934 by a bequest of $10,000 from Dr. S. A. Reed, and is given "for a notable contribution to the aeronautical sciences resulting from experimental or theoretical investigations, the beneficial influence of which on the development of practical aeronautics is apparent." As the recipient is chosen by secret ballot by the Fellows of the Institute, the award carries with it the prestige of being selected by the leaders in the aeronautical sciences—one of the highest honors attainable. An honorarium of $250 accompanies a certificate of award.

The Wright Brothers Lecture. To commemorate the first flights of the Wright Brothers on December 17, 1903, the Wright Brothers Lecture was inaugurated on December 17, 1937. The lecture is given alternately by an American and a foreign aeronautical specialist, and discusses the latest advances in pure science as applied to aeronautics.

In 1938, the interest stimulated by this lecture and the work of the Institute prompted Edmund C. Lynch of New York to create the "Vernon Lynch Fund" by a gift of $10,000, the interest of which is used to endow the Wright Brothers Lecture. The lecture is given simultaneously at the 38 Branches and Sections of the Institute, and through its publication in the Journal of the Aeronautical Sciences the Lecture is made available to the aeronautical profession.

The Lawrence Sperry Award. In 1936, the brothers and sister of Lawrence B. Sperry established a fund of $10,000 to endow an award in memory of their brother. This fund provides for the presentation of a certificate and cash award of $250 to a young man who, in the opinion of the Award Committee, had made "a notable contribution. . .to the advancement of aeronautics." This award, created specially to encourage young men under 30, has been of great assistance in stimulating original aeronautical research and development among the younger members of the aeronautical profession.

The Octave Chanute Award. To commemorate the work of Octave Chanute, one of the earliest American aeronautical pioneers, the Octave Chanute Award was established in 1939 "for a notable contribution made by a pilot to the aeronautical sciences." This award is distinguished from other scientific and engineering awards by recognizing the contributions of the pilot to the advancement of the aeronautical sciences and flying technique.

Two new awards were established in 1940. The Dr. John Jeffries Award will be given for outstanding work in aviation medicine. The Captain Robert Losey Award will be given for advances in aerology, in recognition of the services of the meteorologist to aviation.

The Institute also participates in the selection of the recipient of the Musick Memorial Trophy and other aeronautical awards and honors. Among these is the Daniel Guggenheim Medal, given as an award for achievement in the advancement of aeronautics, which is presented with the other awards and honors of the Institute at the Institute's Honors Night Banquet held every January in New York.

In addition to the bequests made to endow awards, an anonymous donor has bequeathed to the Institute, in his will, securities valued at a half million dollars. Other donations and bequests are under consideration, and it is hoped that after a few years the Institute will have an endowment fund which will make it self-supporting and be able to carry forward an enlarged program which will be of benefit to the aeronautical industry.

The Aeronautical Archives

Many members and friends have presented to the Institute models of airplanes, books, trophies, photographs, prints, medallions and clippings. These became so extensive that the Institute organized the Aeronautical Archives in 1939 as a place where collections of aeronautical interest could be preserved and made available for use of members and the public. The response to the idea of a repository has been so favorable that the Institute now has representative aeronautical collections of many kinds and assurances of other important additions.

The Aeronautical Archives are directly under the financial supervision and ownership of the Institute. It is hoped that on the foundation which has been laid they will be expanded by donations, loans and financial support so that the Archives will become one of the most interesting, useful, and comprehensive centers of aeronautical information in the world.

The Burden Library

In 1939, W. A. M. Burden placed his collection of about ten thousand aeronautical books, magazines, pamphlets, photographs, reports and clippings, forming probably the most complete privately owned aeronautical library in the world, in the custody of the Institute. This addition to the facilities of the Institute laid a broad foundation for the Archives.

and medallions are on exhibit. Two special bookcases, one of which is shown above, contain a collection of rare books on aeronautics dating back to the year 1600.

While the Archives and the Burden Library are open for the inspection and use of the public, it is only possible, for the present, to permit its full facilities to be used by members of the Institute and research workers introduced by members.

The Paul Kollsman Library

In August, 1940, the services of the Aeronautical Archives of the Institute were expanded by a generous gift of $50,000 from Paul Kollsman and the Square D Company of Detroit to establish an aeronautical lending library. This library service loans, without charge, the latest and more important aeronautical books to members of the Institute and others interested in aeronautical progress. Through an exchange agreement with the Engineering Societies Library, any book on general engineering may be borrowed from its great collection of 142,000 volumes.

Membership in the Library is open without charge to all members of the Institute of the Aeronautical Sciences and to any person in the United States over eighteen years of age who can furnish references which certify as to his responsibility and reliability. It is the aim of the Library to render the greatest possible service to those engaged in aeronautical work. It will assist others as much as its resources will permit.

The Aeronautical Index

One of the most important divisions of the Aeronautical Archives is the Aeronautical Index. In February, 1935, in cooperation with the Works Projects Administration, the Institute commenced the preparation of a comprehensive index and bibliography of books, articles and biographies. The personnel have been provided by the Works Projects Administration, and it is believed that the index comprises the most complete reference source on specialized aeronautical information in the world with several million references which relate to every branch of aeronautics. Some divisions of the Aeronautical Index are:

A Subject Card-Index. Reference cards in this section have been classified and cross-indexed under more than 2000 main headings, assuring the immediate availability of references in specialized aeronautical fields.

A Biographical Index. This index, which is kept up to date from the latest books, magazines and newspaper biographical sources, is divided into two sections. A card section contains references to biographical and author material, while the file section contains biographies from newspaper and magazine clippings, as well as other information concerning persons.

Chronologies. This section gives by day, month and year the important events that have occurred in aeronautical development since legendary times. Through cross-indexing, information is quickly located.

A Digest of Technical Articles. The subject card index has been supplemented by a special file of reviews in the field of the aeronautical sciences. These digests, compiled and distributed by the leading international and American reviewing services, have been consolidated, translated where necessary, and cross-indexed with the main author and subject files so that reviews of technical aeronautical material appearing in the world's leading periodicals are immediately available.

Company Files. In this subdivision of the Aeronautical Archives are records of the organization, development and progress of the world's leading aircraft, engine, instrument and accessory manufacturers. In these files are placed releases, photographs and newspaper clippings relating to the company and its products.

General Subject Files. These files contain clippings from newspapers and magazines, reprints, reports and miscellaneous information on aeronautical engineering, airport and airline activities, fuels and lubricants, military and naval aviation, meteorology, radio, awards, flights, trophies, meetings, races, schools and universities, and other aeronautical activities.

Book Title Index. These cards have been arranged alphabetically so that titles of books on aeronautics in all languages may be quickly located.

Author Index. This is a catalogue of the authors of aeronautical books and articles.

Index of Indexes. A consolidation of the indexes of many leading aeronautical books.

Photographic File. Contains photographs of persons, aircraft, and important events in the history of aviation.

Bibliographies of Aeronautics. Fifty comprehensive bibliographies of aeronautics have been prepared and distributed to the leading libraries in this country and abroad. These bibliographies, which will be supplemented from time to time with additional bibliographical information, are not available for sale or distribution to individuals, but may be referred to at the Archives and in many libraries, names of which will be sent on request.

By providing funds to keep the Aeronautical Index up to date, the Institute assists: (1) aeronautical engineers and specialists who wish references on any aeronautical subject, (2) the aeronautical industry, by providing bibliographies on any specialized aeronautical subject, (3) newspaper and magazine writers who desire information for the preparation of articles, (4) governmental departments which require collated information in aeronautical fields, (5) aeronautical organizations which do not have library facilities, and (6) members and others who wish to make specialized investigations.

The Technical Information Service

To assist in providing information from the Aeronautical Archives and Indexes, a Technical Information Service was organized. This service has experienced personnel available to make investigations requiring lengthy searching at the customary fee charged by engineering society libraries. A translation service is provided whereby the technical information appearing in French, German, Spanish and other languages is made available to engineers at a nominal charge. Translated material is carefully edited by trained engineers.

Through a photostatic service, reproductions of any material in the Archives may be ordered at standard rates. A bibliofilm service is available. Special bibliographies on any aeronautical subject can be compiled by the Technical Information Service.

The Journal of the Aeronautical Sciences

The Journal of the Aeronautical Sciences is the official publication of the Institute and restricts itself to the aeronautical aspects of advances in science and engineering. New knowledge in physics, metallurgy, meteorology and other related sciences having aeronautical applications is reported and discussed in the Journal. A few complete professional papers are printed in each issue and a larger number of shorter notes and critical comments.

In general, it is the policy of the Journal to print contributions of scientific and technical interest to members, and to provide an opportunity for them to publish articles disclosing new knowledge and new applications in the field of the aeronautical sciences. Papers read at meetings of the Institute are presented in full or digested in the Journal for the benefit of members who are unable to attend.

The Journal commenced publication as a quarterly in 1934, but since 1935 it has been issued monthly. Through editorial excellence it has come to be regarded as one of the leading scientific aeronautical magazines in the world.

The Aeronautical Review

The increased activity of the aircraft industry was reflected in a rapid increase in the amount of technical information published in books, pamphlets, reports, etc., and in 1940 over 150 aeronautical publications were being received by the Institute. To make this aeronautical information available to Institute members and others it was decided, in October, 1940, to add a review section to the Journal of the Aeronautical Sciences. It was further decided to increase the availability of this information by publishing it as a separately obtainable edition of the Journal.

The purpose of the Aeronautical Review is to keep members and subscribers informed regarding the contents of new books and current periodicals in the field of aeronautics. It reviews new developments in the aircraft industry appearing in catalogues and house organs published by aircraft and engine manufacturers and other companies engaged in aeronautical activities.

A subject classification of the contents of periodicals acts as a specialized guide to permit readers to select reviews in particular fields. Recently published aeronautical books are reviewed so that engineers, pilots, teachers and students may have a general idea of their contents. Through the services of The Paul Kollsman Library any book reviewed may be borrowed by members of the Library, or purchased from it. A section of the Review will print interesting information released by companies which will give news concerning new developments in the aeronautical industry.

The Aeronautical Reader's Guide

To supplement the activities of The Paul Kollsman Library, the Aeronautical Reader's Guide, a catalogue of selected aeronautical books available for loan from the Library, commenced publication in September, 1940. The Guide both lists and comments on books in the Library, and by indexing them under specialized headings also acts as a valuable reference source for aeronautical specialists, companies, libraries and other organizations.

Public Relations

Through visits by Institute officers to aeronautical centers in the United States and abroad, and by addresses and papers, the public is informed as to the excellence and high standards of American aircraft and accessories. By providing aviation editors of newspapers and magazines with information the Institute assists in providing accurate news of the latest scientific and engineering developments in aeronautics to the public. Press reports issuing from a scientific society with a background of Columbia University, California Institute of Technology, Massachusetts Institute of Technology, and the American Association for the Advancement of Science make a favorable impression with the public regarding the work being done by aeronautical specialists.

Social

By association with leading specialists in the aeronautical sciences and in the industry members broaden their acquaintance and acquire valuable friendships which benefit them professionally.

The Membership of the Institute

The administration of the Institute is directed by its officers, the Council, and an Advisory Committee. Many committees conduct individual activities and an experienced staff supervises the active operation of the society.

All members of the Institute receive its publications, as a stipulated amount is set aside from the annual dues of each member to cover subscriptions to the publications. The Institute membership includes executives and engineers of air transport, aircraft and engine companies, aircraft accessory manufacturers, aeronautical technicians, Army and Navy Officers, universities, laboratories and schools. The publications are also sent to a large list of paid subscribers.

According to their experience and accomplishments Institute members are grouped as follows:

Honorary Fellows	Fellows	Industrial Members
Honorary Members	Associate Fellows	Technical Members
Benefactors	MEMBERS	Student Members

All new applicants for membership are elected to one of the four last mentioned grades. Changes to other grades are made by considering published papers, academic position, membership in scientific and engineering societies, research and contributions to aeronautical knowledge. Graduation from an engineering course of a school of recognized standing is considered the equivalent of two years of aeronautical experience.

Honorary Fellows

New Honorary Fellows of the Institute are elected by the Honorary Fellows and Fellows residing in the United States. Honorary Fellows are persons of preeminence in aeronautics and no Honorary Fellow is elected unless three-fourths of all the Fellows voting approve his selection for that grade. Not more than one Honorary Fellow residing in the United States nor more than one Honorary Fellow residing in a foreign country may be elected in any one year.

Honorary Members

Honorary Members of the Institute may be elected by the Council for the period of one year.

Benefactor Members

Persons who have contributed to the Institute the sum of not less than one thousand dollars, because of their interest in the advancement of aeronautics, are elected as Benefactor Members or the Institute.

Fellows

Fellows are proposed and elected by the Honorary Fellows and Fellows of the Institute residing in the United States. A Fellow must have been an Associate Fellow for at least one year and have attained a position of distinction in aeronautics before being eligible for election. He must have made notable and valuable contributions in one of the aeronautical sciences or aeronautical engineering. Not more than ten Fellows residing in the United States and ten Fellows residing in foreign countries may be elected each year.

Associate Fellows

Associate Fellows must have been members for six months or more and ordinarily be over thirty years of age. They must have been personally responsible for important aeronautical developments. They should have been actively engaged for a minimum of five years in aeronautical engineering, research, instruction or the application of science to aeronautics, or they should have attained an equivalent position in work closely allied to aeronautics or in the aeronautical arts and literature.

MEMBERS

MEMBERS are ordinarily over twenty-five years of age and are persons who have completed approved courses in engineering and in addition have been engaged in aeronautical work for at least three years; or they may be persons who have been engaged for at least five years and acquired a recognized standing in aeronautical engineering, research, design, instruction, test flying, the application of special sciences to aeronautics, or the technical development of the construction or operation of aircraft, aircraft engines, or other essential components or accessories of aircraft.

Industrial Members

Industrial Members are those engaged in the application or development of aeronautics who have acquired a recognized standing in the aeronautical field and wish to participate in the activities of the Institute.

Technical and Student Members

The grades of Technical and Student Memberships were created to include young men actively engaged in aeronautics or those studying to become aeronautical engineers. These young men become acquainted with the distinction conferred by membership and are stimulated to do important work in aeronautics so that they may become eligible for advancement to higher grades.

Technical Members are former Student Members and other young men engaged in the technical or industrial branches of aeronautics or work closely allied to aeronautics.

Student Members are graduate or undergraduate students attending those universities or schools at which Branches of the Institute have been organized and which have on their faculties at least one member of the Institute. As only the more promising students are recommended by their professors for membership in the Institute, Student Membership is regarded as a reward for excellence in scholarship.

Student Branches

The Student Membership plan was begun in October, 1936. The Institute now has 31 Student Branches with a combined membership of over one thousand in the leading schools and universities in the United States.

Student Members and Student Branches pay no dues to the Institute, but in keeping with its policy of rendering assistance to young engineers, each Student Branch receives the full benefits of regular Institute Membership. All Branches receive free copies of Institute publications and monthly technical lectures are provided. Branch members are permitted the use of the lending library services and other facilities of the Institute, thus assisting them during their early years in their profession. Special awards have been created for Student Members to stimulate original aeronautical work. Graduating Student Members are automatically transferred to Technical Membership in the Institute and pay no entrance fee.

Sections

In order to render service to local groups of aeronautical engineers the Institute, in 1937, organized Sections in several aircraft centers of the United States. These Sections are directly under the control of and are sponsored by members of the Institute. A grade of Affiliate Membership was created for those persons who wished to associate themselves with a local group interested in the advancement of the aeronautical sciences. Affiliates are not members of the Institute and do not pay dues to it, but through their Sections, which receive the same benefits of membership as Branches, are given the opportunity to hear speakers and participate in activities helpful to them in their work.

The Institute has seven active Sections in Los Angeles, San Francisco, Seattle, St. Louis, Dayton, Notre Dame and Philadelphia, with over 600 Affiliates in addition to the regular members of the Institute. Other Sections are in process of organization.

The purpose of the Institute in organizing Branches and Sections is to provide the expanding aeronautical profession with local interests to supplement the broad general activities of the national society.

Dues

The entrance fee for all members except Honorary Fellows, Honorary Members, Benefactor Members and Student Members is Five Dollars. The annual dues are:

Fellows	$20.00	Members	$12.50
Associate Fellows	15.00	Industrial Members	12.50
		Technical Members	$7.50

Corporate Membership

The aircraft industry spends large sums each year in advertising in aeronautical publications. The larger aviation companies preferred to make contributions to a scientific and engineering society and support the publication of the Journal directly rather than through advertising. The Council of the Institute, therefore, established a Corporate Membership group in 1936. This grade of membership includes all those companies engaged in aeronautical activities who wish to cooperate in the publication of the Journal, the holding of meetings in various cities, and the provision of services to aeronautical engineers similar to those rendered by other professional societies here and abroad. Only companies having some interest in the advancement of aeronautics are eligible for this grade.

The Institute is a non-profit membership corporation and Corporate Members are entitled to deduct their contributions in determining their net income for tax purposes.

Corporate Members engaged in government work in performing Army or Navy contracts may include as a part of the cost of performing such contract or subcontract an aliquot portion of the membership dues paid by them to the Institute.

The Future of the Institute

While the value of the Institute must always depend on the energy, loyalty and mutual cooperation of its members, the actual extent of its work and services will be limited by its financial resources. Fundamentally, the work of the Institute is educational. Its immediate purpose is to advance the aeronautical sciences. The rapid growth of the Institute and the acceptance of its purposes and plans by over 3000 members makes the Institute broadly representative of all aeronautical specialists and the aeronautical industry.

Its future is assured by its steady growth in membership and its increasing endowments. To reflect the high standards of the aeronautical sciences as they are being developed in the United States will always be the primary function of the Institute.

U S A I G

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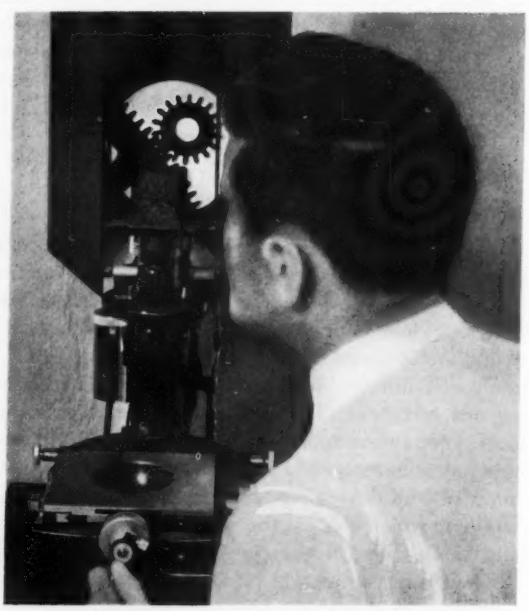

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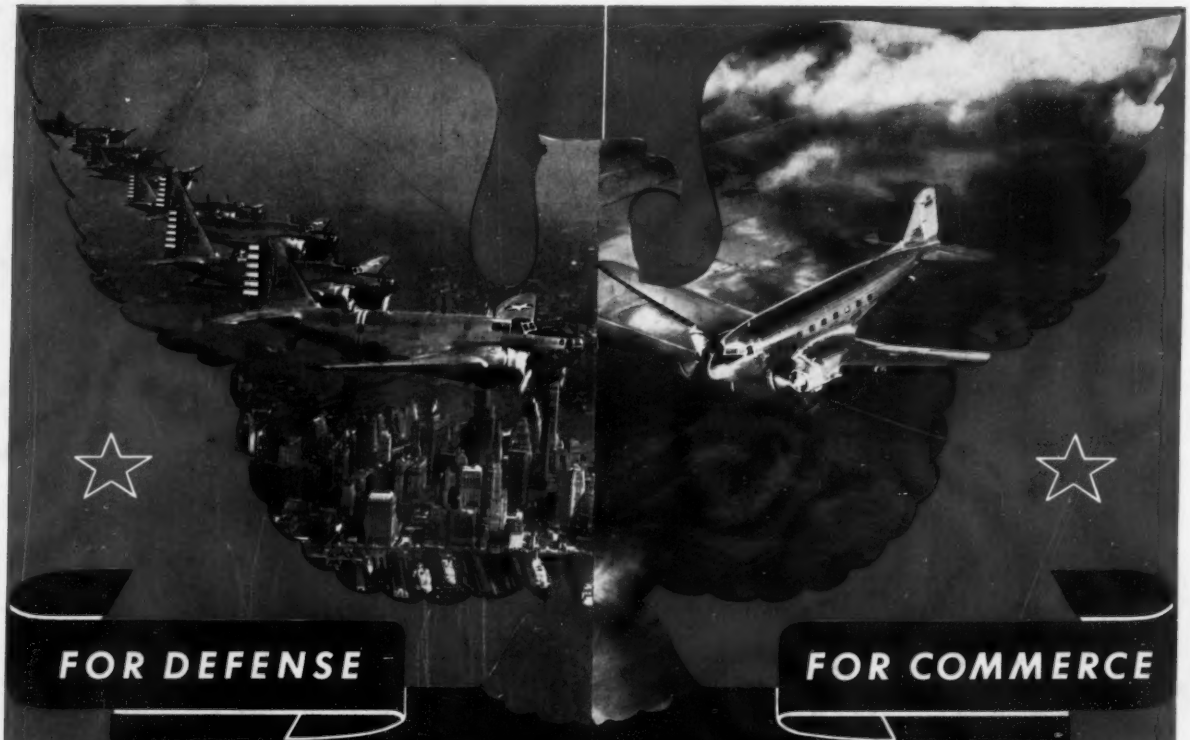

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